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Dr. Rush's Lectures

Chemistry.

Which is a science that teaches the effect  
that of the heat to improve our know-  
ledge of the nature of the body. — That is a

science which explains Expansion, Flexibility,  
Tension of the body. The laws of heat are eight

1. That it constantly removes from a body  
the heat to restore the equilibrium.

2. Its communication requires time, which  
is according to the density of the body. 3. It  
varies according to the difference of figure of  
bodies. 4. The largest surfaces receive the im-  
mune heat of heat best by the

5. The quantity of heat is proportional to the  
surface of the body. 6. The heat is proportional to the  
thickness of the body. 7. The heat is proportional to the  
density of the body. 8. The heat is proportional to the  
figure of the body.

The quantity of heat is proportional to the  
surface of the body. The heat is proportional to the  
thickness of the body. The heat is proportional to the  
density of the body. The heat is proportional to the  
figure of the body.



...a positive quality derived from the  
Cold is negative & is the absence or diminution  
of heat. There is no body naturally so cold that it  
does not or cannot afford any heat. & I  
Mixture of Snow & Aqua fortis sink the  
40° below 0. We can come at the knowledge of

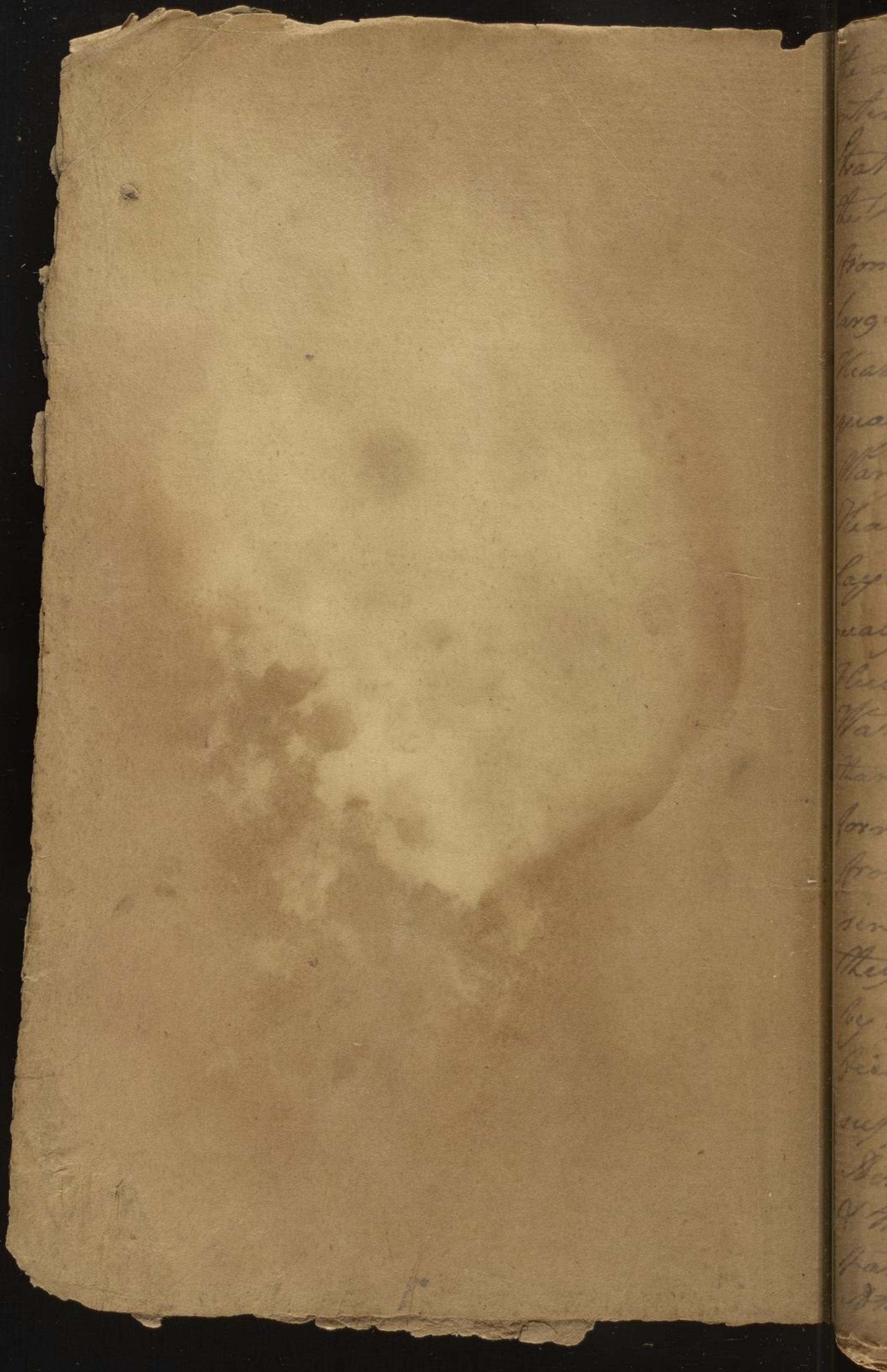
only by considering its effects. That don't add to the  
weight of bodies in expanding them. In the Arctic  
circle the  $\sigma$  stood 65° below frost. In Siberia 152° below  
frost; at Petersburg it stood 40° below frost. By mixing  
Snow & Aq. fort. it fell 350 & 320° below frost & it con-  
galed.

4. Two bodies of the same matter & form but  
different in quantity, heat & cool in pro-  
portion to their diameters. Latent heat  
enters into the formation of the particles of  
bodies & is not obvious to our senses; but Sen-  
sible heat occupies the spaces between the  
particles & is obvious to our senses.



The most equal Heat is that communicated  
by the Balneum Mariae. Heat pervades  
all bodies. Air don't conduct Heat, only in  
proportion to the quantity of heterogeneous  
particles with which it is mixed. Water  
conducts Heat. There are conductors of non-  
conductors of Heat as well as Electricity.  
The difference of climates depends, on the  
quality of the soil; 2<sup>nd</sup> cultivation; 3<sup>rd</sup> Par-  
ticular Winds from certain quarters as  
the Sirocco Winds; 4<sup>th</sup> Proximity of great bodies  
of Water; 5<sup>th</sup> state of water on the surface  
of the Earth; 6<sup>th</sup> Perpendicularity of the  
sun; 7<sup>th</sup> the presence of clouds. Heat flies  
upwards from the Earth & Water. Islands  
& Land near the Sea are warmer than  
continents, because the Heat flying from  
the Sea in greater quantity than Land, warms  
the Atmosphere. They are also cooler in  
summer because the rays of the sun are  
impeded by clouds, which are mostly in  
greater quantity for good & plain reason.  
Transparent bodies transmit Heat & Light.  
Valleys are warmer than Mountains, because







the air being denser over the former, by the  
continual pressure of the superincumbent  
strata & a well known Law of gravitation,  
the Heat is better absorbed & retained, both  
from the Sun directly, & indirectly from the  
larger surface of the Earth, from which the  
Heat escapes. In Vacuum the Heat flies  
equally from all sides of a heated body.  
Many Phenomena are accounted for by the  
Heat flying upwards, & the more dense  
layers of air falling down & thus conti-  
nually renewed. Ice & other cold bodies descend.  
Fluids are heated soonest near the bottom.  
Water in the Seas & Lakes is much warmer  
than in Rivers or Shallow places; in the  
former the warm water rises to the top  
from the bottom, whilst the cold & dense  
sinks to the bottom on which account  
they hardly ever freeze; the air is warmed  
by it. The air near the Earth when rare-  
fied always flies upwards & its place is  
supplied from above by the denser air. The  
Air receives its warmth from the Earth  
& the action of the Sun on the opaque  
particles contained in the air, hence the  
Atmosphere nearest the Earth is always



The freezing & expanding of water by freezing  
is not owing to its absorbing air, as it expands  
by freezing & has the appearance of air bubbles  
on being deprived of air. The air bubbles being  
devoid exhibited no phenomena moving the frame  
of air in them. The appearance of Ice is rough  
angular. Snow is of a radiated star-like appearance.  
Snow contains no saline matter, as it is the purest  
of water & very homogeneous. The reason that Iron  
expands after being melted is because the particles  
touch at angles.

Iron is proved to be expanded by its requiring a large  
hole to pass thro when heated than when cold.  
Its contraction when cold is proved by the Cooper's  
method of hoops casks & by the French Burre.  
2<sup>d</sup> Water put into a tube & immersed in warm  
water will rise. 3<sup>d</sup> A bladder partly filled with  
air & placed before a fire will burst by the ex-  
pansion of the elastic air.

Water is proved to be compressible by its rising  
in a glass tube, on taking off the pressure of  
the Atmosphere. The Accuracy of Thermome-  
ters depends on the thickness of the glass, 2<sup>d</sup> Figure of the  
bulb; & 3<sup>d</sup> the uniformity of the cylindrical tube.  
The size of the Bulb should be directly as the size  
of the stem. The Bulbs of Thermometers should  
be black to conduct the heat best.

Thermometers are graduated by plunging in  
into Snow, measuring the height of F. & then into  
Boiling water, measuring its height & marking the  
proportions between them.



lect. 3. All bodies are expanded by Heat. Water  
is expanded by freezing. The expansion of Ice is  
owing to the tendency of the particles of Ice to  
touch at an angle of  $60^{\circ}$ . Particles of Metals  
touch at angles. Wrought Iron is more compact  
malleable than cast by reason of the particles  
being brought closer into contact & their  
disposition altered by the hammer. No body  
contains a definitive quantity of Heat.  
Expansion is manifested on 1. Solid bodies, as  
Metals. 2. Inelastic fluids as Water, Oil &c.  
3. Elastic fluids as Air. Expansion & con-  
traction are the consequences of <sup>the application of</sup> Heat & Cold  
to almost all bodies. Iron & Regulus of Antimony  
expand by cooling after being melted. Polished  
bodies reflect almost all the Heat, & rough  
bodies absorb it more. Thermometers are Instru-  
ments used to ascertain the degrees of Heat &  
of Cold. They are made of Air, Alcohol, Oil, Water,  
and Mercury. The bulb of a Thermometer should  
be an Oblate Spheroid. Dr. W. Wilson of Edin-  
burgh found that Air in the tube made no dif-  
ference. The bulb shouldn't be too bright.  
In the graduation of Thermometers the heat of  
boiling water or  $212^{\circ}$  is the highest, & that at  
which Water freezes or  $32^{\circ}$  is the lowest.

fixed

as point

on the



It has been frequently congealed.  
Water freezing in a globe of an inch Diameter  
exerts a force equal to 22700.  
It requires too large a scale. Ice is too easily  
congealed, & nullifies the tube.

Iron & Water take the same degrees of Heat  
to lead them equally; which is the reason that  
Iron heated red hot is used plunged into water to  
ascertain the degree of heat the iron contains.

A piece of Ice blown upon by bellows will melt  
sooner than if it was not blown upon.

The imperfections of Thermometers are two viz.  
1<sup>st</sup> Too much time is required for ascertaining the  
degrees of Heat & Cold. 2<sup>nd</sup> They are limited i.e.  
into there are degrees of heat too great to be  
Boiler measured by them.



Mercury is the best fluid to make thermometers  
of. The coldest body in Nature can ac-  
quire more cold. Heat is positive & cold negative.  
Snow has no salt as has been absurdly imagined.  
Potatoes originally of Mexico grow in Siberia  
as well as many other rare plants. Siberia  
is colder than Polar circle. Snow or Ice &  
Aqua fortis make a great degree of cold.  
100° below 0. Heat in diff. bodies is not  
the same. The cold caused by the mixture of  
Ice & Aqua fortis is owing to the sensible heat  
absorbed & rendered latent by the Ice in its  
conversion into fluid. Lect. 4. Air at rest  
is warmer than <sup>in</sup> motion, because the heat  
escaping from diff. bodies is not carried off  
as fast as it would be by air in motion, but  
forms an atmosphere round the bodies; air  
in Motion also increases the evaporation of  
fluids & consequently the cold. Air blown upon  
the bulb of a Thermometer raises the Mercury  
by the heat excited by the friction of the air.  
Mercury, Silver & some subtle Oils are as yet  
alone incapable of being frozen. We are un-  
acquainted with the lowest degree of cold &  
highest of heat. In ounce of Ice suspended  
in a room when the  $t.$  is at the freezing point  
will lose a good deal of its weight in about 12 hours.



Some bodies are made more easily fusible by mixture with others, which are called Fluxes. In expansion there is a regular increase of bulk according to the degree of heat applied; but in fluidity the transition is sudden. ~~Water~~ alone appears in an intermediate state of ~~being~~ between fluidity & ~~expansion~~ solidity. Some calces of Metals vitrify. By fusion Bodies are capable afterwards of being restored to their former state. Fluidity of bodies depends on a certain quantity of latent heat. Some white stones resist the action of fire on account of this not conducting heat.



It is accounted for by the first law of heat.  
Frost is produced by evaporation; thus the  
Dew after remaining upon the grass all  
night in cold weather, would become frost till  
after sun rise, which altho' it warms the air  
increases the evaporation of the Dew & thus  
makes frost. Ice & Snow stimulate & irritate.  
It is thus they cure frozen limbs, restore  
frozen fruit &c. It is impossible to sleep with  
cold feet: this is remedied by exposing them  
to cold sometime as by standing on a marble  
or by slab or the like. Fluidity is the natural  
state of <sup>all bodies.</sup> Wax & Resins, Ice & Metals  
fuse. Earth & Stones vitrify. Fusion is  
the reduction of a solid body to a fluid state,  
by which its properties are not the least  
altered. Friification is the reduction of a body  
to a brittle, <sup>transparent</sup> state by which its properties  
are materially altered & from which it can  
never be restored to its former state. Aqua fortis  
or M. Vit. & water raise a great heat by the  
conversion of latent heat into sensible; thus  
fermentation, effervescence &c. Heat is divided  
into Latent & sensible. The former is a power  
capable of exciting that sensation. Think  
with the Wise & speak with the Vulgar.



The pressure of the <sup>air</sup> is to be considered in Evaporation  
for water evaporates at  $90^{\circ}$  of heat when this is taken  
off. Evaporation is when the volatile parts  
of a liquid rise, & leave a fixed residuum behind.  
The evaporation of Camphor is called Spontaneous.  
Windy weather increases the rapidity  
of the evaporation because the vapour is carried  
off as fast as generated. The vapour produced by heat  
is strongly elastic, but that by spontaneous evaporation  
is inelastic.  $\text{H}_2\text{O}$  boils at  $212^{\circ}$  in vacuo. Spontaneous evaporation depends on the  
stronger attraction between the particles of  
Air & water than between the particles of  
water themselves. The heat of a common fire  
or  $1050^{\circ}$  makes Iron Red hot. At  $635^{\circ}$  it shines in  
the dark.  $600^{\circ}$   $\text{Fe}$  &  $\text{Pb}$ . Lead boils,  $525^{\circ}$  Lead  
Melts.  $569^{\circ}$   $\text{Pb}$ . Terrel. boils.  $550^{\circ}$   $\text{Pb}$ . Melts. boils  
 $460^{\circ}$  Bismuth melts  $408^{\circ}$  Tin melts.  $174^{\circ}$   
 $\text{H}_2\text{O}$  boils  $156^{\circ}$ . Silver evaporates.  $110^{\circ}$   $\text{Fe}$   
magnesium melts.  $105^{\circ}$  ferric heat.  $15^{\circ}$   $\text{Fe}$   
by heat.  $45^{\circ}$   $\text{Fe}$ . Summer heat.  $21^{\circ}$   
Vinegar freezes.  $20^{\circ}$  Strong wine freezes.  
 $\text{H}_2\text{O}$  Great cold observed in England. One  
type of snow & salt.  $23^{\circ}$  below 0 mark  $\text{H}_2\text{O}$   $\text{H}_2\text{O}$   
freezes.  $150^{\circ}$  a congelation of  $\text{F}$ .  $352^{\circ}$  according  
to Brauer. — The vapour of spont. Evapor.  
is inelastic & depends on heat generated cold &  
is increased in proportion to the heat of the atmosphere.



Evaporation excites cold by the absorption  
the conversion of sensible Heat into latent to  
the use vapours. Water unagitated freezes later  
than agitated, because the evaporation & ex-  
pansion of the latent heat is more speedily  
effected by the exposure of a larger surface  
to the action of the air. Fixed & Volatiles  
are comparative terms; nothing being  
perfectly either. Vapours very elastic.  
Water is hotter just before boiling than when  
it boils, because then the heat escapes with  
rapidity, & the evaporation goes forward.  
Water confined by the air is capable of  
bearing a greater degree of Heat than 212°  
indeed of being made red hot; as the Colophite  
does. The bottom of fluid heat <sup>causing the ebullition,</sup> rises  
to the top, while the more dense  
cool subsides to the bottom. Sublimation,  
Distillation, & Evaporation are employed  
to purify & extract the virtues of substances.  
The first is employed with solid sub-  
stances as Camphor. Vol. Alkali. Arsenic &c.  
The other with fluids. It is more dangerous  
to sit in a damp room with a fire than  
without. Distillation & Sublimation are the  
reverse of Evaporation; in the two former, the fluids  
& solid parts of bodies are preserved. —



A stream of air also favours Evaporation.

The vaporific point of some bodies is below the point of their fluidity, as Camphor &c. but in others requires more heat as Water &c. It requires 5 times the length of time to dissipate water into vapour that is required for its boiling.

Vapour is a rare, elastic, compressible fluid capable by ~~the~~ cold of being condensed.

Water & Allogiston, &c. make Resins, Oils, &c. &c.

Water & Acid, fluor Acid, & Alkali fluor Alkali.

Water & Allogiston make Aether Spirit.

The discharge from the surface of a body by perspiration & sweat is always in proportion to the degree of heat the body is exposed to, & the cold generated in the body by the vaporation of its fluid, is proportional to the Discharges. Ignition is the most general & uniform effect of Heat. All bodies are capable of ignition, provided we can confine their vapour.



& greater the heat  
The larger the surface, the more speed is  
the evaporation. Vapour is always produced  
by heat. Fog & mists from stagnating &  
stagnant bodies of water, are hurtful for  
two reasons, first because damp in general  
evaporation generates cold, secondly because  
of their direct action on the solid & vessels & fluids  
they prove poisonous. Many curious  
phenomena are accounted for by the con-  
version of sensible heat into latent & vice  
versa. Wax & Resins are alone gradually  
melted & congealed, other substances have no  
intermediate degree. Water does increase  
in weight by freezing. Water will freeze  
in vacuo by the evaporation of other sub-  
stances & placed in the water.

Lect. 5. The heat of the human body is the same  
in all climates under the equator as under the  
Poles. from  $96^{\circ}$  to  $100^{\circ}$ . In Syria the heat rises  
to  $144^{\circ}$  without injuring the health. In Caro-  
lina to  $126^{\circ}$ . Sweating cools the body as evapo-  
ration does. All bodies capable of emitting  
light & heat, & appear luminous are ignited  
by friction. Air is not surcharged with vapour  
by inflammation, but phlogiston. It is fixed  
air as obtained from calcareous earths &c.



The Inflammation is not so general. It is  
fired to a class of bodies called Inflammable.  
They are those which <sup>by the action of heat</sup> when set on fire will flame.

Even V & A are said to leave a residuum behind.  
The principle of inflammability is never destroyed.  
It is the same in all bodies. It is called Phlogiston.  
It is pure principle & cause of flame, ulti-  
mately the same as Electric fluid. It possesses  
absolute levity. Calcination is the change  
Metals undergo by absorbing Dephlog. Air.  
The calces of Metals are heavier than in their  
Metallic state. Water united with O<sub>2</sub> will not  
evaporate in a degree of heat below 300° or 400°.  
Phlogiston can't be obtained pure & separate.

Black says one fluid can dissolve another &  
the fluid in a largest quantity is called the  
solvent.

nd. or  
se can



The conical figure of flame, is owing to  
the pressure of the air. Wood confined  
affords very little soot, which is Phlogiston  
a Vol. principle. Vit. acid of charcoal  
is Sulphur. That is the grand enliven-  
ing principle of Nature. By it we account  
for Rain, snow, Hail &c. Vapor its presence  
depends the fluidity of all bodies that are  
fluid. Mixture, is the union of dis-  
similar ~~parts~~ bodies. 1. Bodies by combustion  
suffer a diminution in weight; 2<sup>nd</sup> They all leave  
residuum; 3 They burn according to the purity  
of Density of the air; 4 They burn for a certain  
time in a given quantity of air; That is a  
fresh supply of air is absolutely necessary  
for combustion. They impart Phlogiston  
to the air. All bodies contain Phlogiston.  
If the heat were abstracted from the air, it  
would become a solid, concrete mass.

Lect. 6. There are three kinds of mixture  
viz. Chemical Mixture, Solution & Diffusion.  
In <sup>Chemical</sup> Mixture the solvent & solvend form a trans-  
parent homogeneous fluid; a change of properties  
takes place; heat; & no more than two bodies together  
Bodies become more fixed by mixture.



Bodies are said to effervesce, when they rub  
together with great violence & impetuosity  
sending forth fumes; as by mixing  $\text{O}_2$  &  $\text{H}_2$ . Sal. Am.  
The union of  $\nabla$  with Nitre, & Camphor with  
 $\nabla$ , is an instance of Solution. — To do this  
the bodies must be in contact, & the more they  
are, the more powerful is the attraction.  
It is the same as Attraction of cohesion.

Macquer says, Maceration is the solution of a  
body in a cold Menstruum.

In solution the solid body is so intimately united  
to the fluid, that it remains there in a homogeneous  
state.



Some Mixtures are not uniform; some grow  
hot, others cold; some with impetuosity,  
others without. Solution is the simple  
union of bodies. In it, no change of properties  
testum quid takes place; cold is caused,  
more than one body can be dissolved in an-  
other. The addition of another body to a solution  
enables it to dissolve more of the first,  
by conveying more water into it. Macera-  
tion is the solution of bodies with less heat  
than that of boiling water, continued. De-  
coction is with the heat of boiling water  
long continued. Infusion; the heat of boiling  
water is continued but for a short time. <sup>Of either cold or hot.</sup> Digestion  
without boiling. In Circulation the va-  
pours are returned again on the body. De-  
liquescence by exposure to the air & absorbing  
its moisture. Amalgamation, the solution  
of a body by Quick silver. Bodies dissolve  
in proportion to their surfaces, 2<sup>nd</sup> the heat  
employed; 3<sup>rd</sup> the agitation of their parts;  
4<sup>th</sup> the exposure to air, as proved by experi-  
ments in Vacuum; & by only the surface of  
fluids, preserves & boiled in copper vessels, dis-  
solving the copper.



Decomposition is the disunion <sup>or separation</sup> of the component parts of bodies. Crystallization is the concretion of a body into a certain <sup>or mass with polished surfaces, more or less transparent</sup> regular form. Precipitation is the separation of a dissolved body from its menstruum by the addition of another body. Cohobation is the returning of a liquor, distilled from any substance, back again upon the same substance, & distilling it again.



All astringents lose their astringency, but  
of their better by Decoction & Infusion.

Diffusion or Mechanical Solution; the  
union is not intimate; the mixture is turbid,  
not permanent & requires constantly agitation  
to prevent the separation of the bodies, & a  
sediment from being deposited. Decompo-  
sition is performed by 1. Precipitation,

Crystallization 2. Evaporation. Preci-  
pitation; 1<sup>st</sup> of the dissolved body. 2<sup>nd</sup> dissolved body  
& precipitant. 3<sup>rd</sup> of the Menstruum alone.  
4<sup>th</sup> menstruum with the precipitant.

Crystallization, by diminishing of heat,  
or quantity of menstruum. Evaporation,  
volatilising the menstruum into vapour.

Attraction in chemistry better known than affini-  
tety, is that steady, invariable law of Nature  
by which the Particles of bodies are disposed  
to unite together. The remarks on Attraction  
are as follows. 1. Only in point of contact. 2<sup>nd</sup> One  
of the bodies must be fluid. 3. The minuteness of  
the atoms goes almost beyond description. 4<sup>th</sup>  
Not more than four bodies together. The more  
divided the particles, the more speedy & intimate  
the mixture. Attraction, single elective  
Attraction & double elective Attraction.



The action of one body on another is effected  
in 3 different kinds of vessels <sup>viz.</sup>  
1<sup>st</sup> by solution, Evaporation & Fusion

The apparatus of producing heat is of seven kinds viz.  
1<sup>st</sup> Animal heat, seldom used, it is very uniform but  
too low. Heat can always be determined by the thermometer.  
2<sup>nd</sup> Description of solid bodies, is seldom used & the effect is too  
transitory. 3<sup>rd</sup> Electricity is little in use, by it Metals  
are fused. 4<sup>th</sup> Mixture produces transitory heat little used.  
5<sup>th</sup> Fermentation is used when a slow, long continued  
heat is required as in hatching chickens, & in Vegetation.  
6<sup>th</sup> Insolation, is used in extracting the virtues of  
Gums &c. as uniform, it may be collected in a great  
degree by a Burning glass. Ferret 7<sup>th</sup> is mostly  
used as it is capable of affording a very gentle or very  
intense heat.

1<sup>st</sup> Fluid inflammables are the most equal & man-  
ageable sources of heat. Sp. Vini. is the best. The flame  
of Oil emits soot. Peat & Turf is too spongy & bulky.  
When crude it emits smoke diminishes the heat & spoils  
the vessel. 3<sup>rd</sup> Charcoal of Wood is mostly used, it is capable  
of producing the most intense heat. It kindles quickly,  
has few vapours & leaves few ashes. 4<sup>th</sup> Poplar coal charred  
is like the other nearly. It emits no gross smoke, & contains  
not so much Ologiston as Charcoal. 5<sup>th</sup> Wood charcoal is  
very bulky, requires much air, leaves much ashes & the heat  
is improper when a moderate, equal & long heat is required.  
The forms of chemical vessels are different according  
to the nature of the Operations we perform in them.

Black Lead vessels bear the most intense Heat.



Lect. 17<sup>th</sup>

The solution of one mixture body by another  
called Attraction. Elective Attraction is  
that property of a body by which it has a  
greater attraction to one particular body than  
any other. Double Elective Attraction  
that power by which two diff. compounds  
are formed by the mixture of several bodies  
together. The second is instanced in Sal. Sal.  
Ammon; the third in a mixture of a solution  
of Sacchar Saturni, & Sal Martis & or Copperas.  
Attraction & Repulsion are the 2 great  
principles of Activity in the Universe.  
Means of applying Heat are 6<sup>th</sup> 1<sup>st</sup> Fires, as  
1<sup>st</sup> Fire & Oil, 2<sup>nd</sup> Peat & turf, 3<sup>rd</sup> Charcoal & Wood,  
& Dung, 5<sup>th</sup> Crude fossil coal, 6<sup>th</sup> Culm or Fossil  
coal charred by burning. Wood & Charcoal give  
the best & most intense heat. Chemical Appara-  
tus should be 1<sup>st</sup> transparent, 2<sup>nd</sup> incapable of  
being acted on by solvents, 3<sup>rd</sup> strong & close, 4<sup>th</sup>  
bear sudden vicissitudes with <sup>breaking</sup> melting, 5<sup>th</sup> should not  
melt. They should be spherical to contain the  
greatest q<sup>ty</sup> of matter in the same space, to  
bear pressure; & in order that the heat may be com-  
municated in a more equal manner. They are  
made of glass, Metals & Earthen ware, the latter  
mixed with sand & strongest, & bear a greater heat.  
Fusion or dry solution. Precipitation by fusion  
is called Regelut, & Scoria.



The Heat of fermentation is  $120^{\circ}$ . Gold &  
Silver make the best Metal Vessels but are  
too expensive. Glass is better. The thinner it is  
the better. It should be heated often & gradually afterwards to  
strengthen it. Crucibles & Coppers are employed  
in Fusion. In evaporation 3 diff<sup>t</sup> kinds of ves-  
sels are used. viz. 1. Such as retain the fixed & dis-  
solv<sup>d</sup> parts. 2. Such as retain the volatile  
matter as in distilled & sublimation. 3. Such as  
contain bodies which act on each other. The  
means of applying & regulating Heat are by  
Furnaces. ~~See B. III.~~ Additions are made  
to substances in distillation, to fix vol.  
principles, 2<sup>nd</sup> promote the volatilisation of fixed  
principles, 3<sup>rd</sup> promote their solution by more  
minutely dividing the parts of the bodies.  
Eliguation is the precipitation of Metals by the  
flowing out of a part. By Congelation the  
diff<sup>t</sup> Metals are separated. Additions are made  
to prevent fusion, intumescence & regulate  
heat. Rectified. Dephlegmat. & Concent.  
~~Concent.~~ are partly the same used to express  
the deprivation of diff<sup>t</sup> fluids & acids of their  
Phlegm & extraneous bodies. Destillat. per latus  
as in Retort & Receiver per descensum as Tab. Turb.  
per ascensum as Fire & distilled waters.



Earthens vessels resist the most in-  
tense heat without melting, & are not easily corroded.  
They are not transparent & can't be made very  
strong. Some are made of clay, & clay & sand. M.  
Pott properly prepares the powder of burnt clay.  
Porcelain clay is the best earth for making  
chemical vessels. The vessels employed in  
fusion are Crucibles, & Cusplets. Crucibles  
are vessels of a conical form broader above than  
below, for the better collecting the fixed body into  
one mass. They are generally triangular. They  
are made of clay & sand as the Neapian; & of  
Black lead with a little of the other two as the  
Turkian. Cusplets are made of dry porous  
earths as ashes of Bones, & wood well calcined &  
leptivated. They are wide mouthed vessels like  
Glad cups. Roasting tests are the same.

The vessels used in the 1<sup>st</sup> kind of Evaporation  
in dissipating the volatile parts & retaining of  
fixed, are open vessels of diff. forms, & ma-  
terials. If the substances are corrosive, we use  
vessels of a globular figure converging at the  
top, made all of glass. If not corrosive the  
tubie & earthen pans. If the heat is very great  
Crucibles are used. The vessels employed in the 2<sup>d</sup>.  
kind to retain the vaporated matter, differ accor-  
ding as the matter is fluid or solid; when fluid  
it is called Distillation. Distillatio per ascensum,  
is when the heat is applied below, the vapours rise,  
is turned aside into a refrigeratory & condensed.



On Distillation per descensum. the head being ap-  
plied above, the vapour falls directly downwards  
into a condensing vessel filled with water. For  
2<sup>d</sup> Turpentine are obtained in this mode. In dis-  
tillation per lateres, the vapour produced issues  
laterally through the neck of the vessel placed  
by the side of that cont<sup>g</sup> the matter operated on. In  
the first kind we use the Alembic or still; which  
consists of 1. The cucurbit or body for containing  
the matters for distillation, or water in which is  
immersed, a vessel of the same name & form to  
contain the matters for distillation in the Wa-  
ter Bath. These vessels are of a globular  
form not very deep & wide. The first is of cop-  
per, & the second of tin. 3. The Capital,  
the lower part of this is fitted in the body by  
its neck. At the side of the capital is a pipe  
communicating with it, called its Beak. 4.  
The Refrigeratory, which surrounds the ca-  
pital; in its side near the bottom is placed the  
Cock. This vessel contains cold water to con-  
dense the vapours in the capital, the water  
when too warm is let out by the cock & renewed.  
Instead of this some use a Worm; the upper  
part of which is connected to the Beak of the  
Capital. It is a long, spiral pipe surrounded  
by a Bucket cont<sup>g</sup> cold water. The lower part  
of this is fitted in the Receiver or Vessel to con-  
tain the condensed vapour.



Lat. of Elements are the principles  
simple in themselves &  
of matter, incapable of divisibility, not cognizable  
to our senses. They are the simple & ultimate  
principles of bodies. A mixt is a compound body  
of several aggregates. An aggregate is the assem-  
blage or collection of many homogeneous particles  
into one mass. The objects of chemistry are divid-  
ed into 1. Salts 2. Earths, 3. Inflammables, 4.  
Metals, 5. Waters, 6. Aers. Water, Earth, &

Aers are severally heterogeneous & capable of  
being divided into their constituent parts.

Earth is composed of Water, Salt & Air. Water  
has in its composition Air, Earth & Water. Salts

are white, transparent, fusible bodies of great  
solubility, not inflammable, & converted into  
Vapour. <sup>by heat</sup> Air is extricated in the solution of

Salts by water. The solution of Salts in water  
generates either heat or cold; the Crystalline cold  
& the deliquescent as Sal. Tart. &c. Heat. If Sal.

Nitr. is added to a saturated solution of Sal.  
Common. the more it is capable of dissolving by  
a fresh addition of water in the chry state of the

Sal. Nitr. They differ in degree of fusibility  
& solubility. Hot & cold water dissolve an  
equal quantity of common Salt. The hotter

the water, the more is dissolved of all salts but  
common Salt. Air is required to dissolve Salts.  
The solubility differs in the following order;



Agitation assists the solution of salts.  
The first portion of salt which is added will be  
dissolved in less time than those afterwards added.

Sal. Glaub. contains  $\frac{1}{2}$  water. Hence water  
fusion, spont. calidat. & de residat.

Water is said to be saturated, when after  
the addition of a certain quantity of salt,  
it will dissolve no more. Salts are separated  
from water by evaporation & with a brisk continued  
heat untill dryness. 2. By a gentle heat & partial  
evaporation, untill a pellicle appears on the  
surface, when it is set in a cool place to  
crystallize. The pellicle is produced by the  
particles of the salt cohering, so much of the  
water being dissipated, that the remainder is in-  
sufficient to keep the whole in solution. What  
is the efflorescence or evaporation of salts? As  
soon as the crystals begin to form, they are at-  
tracted by the side of the vessel, & protruded up in  
the form of a hollow cylinder at the top & down  
the outside, this forms a syphon, by which the  
solution is drawn out of the vessel. It is then  
accounted for, when the liquor is set red, the sur-  
face being exposed to the air, immediately concretes,  
the centre sinks down & is again dissolved. But  
the sides attract the part next them, & draw  
it up, which concretes at top, &c. This is preven-  
ted by rubbing the vessel with oil &c.

Crystallization is employed in separating  
salts. Crystallization depends on Attraction.



viz. Veg. Alkali most, then Regen. Carb. Sal.  
Glauc. Sal. Digest. Common Salt. Common  
Ammon. Common Nitre. Cubic Nitre  
Vit. Part. The water in which salt is dis-  
solved occupies more, frequently less space.  
Sun is that is best for regular & slow evapo-  
ration. Evaporation is used to decompose salts,  
& Precipitation for Crystallization.  
Acids & Alkalis separately precipitate  
Neutral Salts. Vit. acid attracts water very  
powerfully, since <sup>it</sup> ~~it~~ in 24 hours absorbs  
one Drachm. of water from the air. Cryst-  
allization goes forward best without motion,  
during it a pellicle is formed on the top of the  
solution. If a few drops of it dropped on glass  
soon grow hard & solid, it shows that it is suffi-  
ciently evaporated. Cold applied suddenly  
or in too great a degree, causes instead of Cryst-  
allization the Salts; they should be cooled gradually.  
As hot water dissolves to parts of Nitre when  
cold it thickens when cold; the salt is in fact precipi-  
tated when cold. Crystals contain a great  
deal of water & air. Every kind of salt has pe-  
culiar figure of crystals but it is not a criterion  
as they may be changed by two crystals  
joined together or to those of different salts.



Wet acid united with ardent Spirit  
produces Nit. & Ether.



Salt exposed to air becomes powdery; this  
is called, spontaneous calcination; description  
tion is the crackling that salts make, when  
thrown into fire. Salts are divided into  
Simple & Compound. The simple into  
Acids & Alkalies. The acids into ~~Vegetable~~  
<sup>Vegetable</sup> Mineral, & Animal. The Mineral into  
Vitriolic, Nitrous, & Mariatic; the Phos-  
phoric acid is added by Bergman; also the Selenic,  
but not properly. The properties of the Mineral  
Acids are as follows. viz. 1<sup>st</sup> Fluidity, 2<sup>nd</sup> Attraction  
for water. 3 Cold is generated on their dissolving  
ice; but heat on their mixture with water.  
4. A red colour is thickened on their mixture  
with Syr. Viol. or any Vegetable Blue. 5.  
They effervesce with Alkalies; this is occasioned  
by the escape of fixed air; as perfectly caustic  
alkali would effervesce. 6 Very corrosive.  
7<sup>th</sup> They impart a sour taste to the tongue,  
and ~~shrink~~ <sup>are shrunk</sup> & corrugate generally the fibres.  
The Vitriolic acid is combined with Iron,  
is colourless & transparent, not inflammable,  
improperly called Oil, but the sensation of oil  
is occasioned by its dissolving the unctuous  
substance at the ends of the fingers, which  
is there in great abundance. It is not altered  
by great heat; it boils with several 100 of heat.



The specific gravity of  $\text{Ox. Vit.}$  is to Water as  
17 or 18 to 10, & nearly double according to its  
concentration.

$\text{Vit. acid}$  is used in Dying, Bleaching, & the  
Manufacture of Sal. Glaub.

There are simple elementary bodies in Nature  
as proved by the unchangeable Nature of an  
Oak Tree. They are not cognizable by our  
Senses. —

The  $\text{vit. acid}$  dissolves all Veget & Animal  
substances & becomes black directly as the  
quantity of Phlogiston they contain. —



It dissolves instantly with water. It attracts  
the Alkalies the most powerfully. United  
with calcareous Earth, it forms Selenite;  
with Argillaceous, Shale; & Earth of  
Magnesia, Epsum Salt. It attracts Phlo-  
giston powerfully & most so. It attracts  
it from the air, which causes its black colour,  
It is made transparent again by boiling.  
Its union with Sulphur. Phlogiston forms  
Sulphur; which is an instance of the most  
surprising change & modification in all che-  
mistry. Mixed with Oil of Olives it turns  
it black like Tar; with Turpentine head  
& fumes arise. It dissolves all the metals but  
Gold; it requires being mixed with water to  
dissolve Iron & Zinc; being highly concen-  
trated to dissolve copper; it must be boiled to  
dissolve the rest. The Atmosphere always  
has an acid in it. There is water always in the  
Air, even in the hottest & driest times. It  
mixed with water cont. calcareous earth, causes  
a deposition which is Selenite. Vit. acid com-  
bined with Ven generates cold & is called solution,  
with water heat is called ~~acid~~ mixture.



In Distillation per latus. We use Retorts, Receivers,  
& Adaptors. Retorts are Pyramidal bodies with  
the upper part formed into a Neck, & so bent that  
it makes with the body an angle of  $60^{\circ}$ . It is divided  
into Belly, Arch or Roof, & Neck. Glass ones are  
used in all operations that require less heat if it  
is sufficient for their fusion. Earthen when great  
heat is required. From for &c. a few other substances.  
Receivers are vessels of glass adapted to receive  
collected & contain the product of distillation. They  
are called according to their forms, Balloons.

Matrasses &c. Some Retorts & Receivers are tubulated.  
Adaptors or Mucels are a kind of Pots or Capsules,  
open at both ends, & are inserted or applied above  
each other, so that the whole forms a pipe or tube  
to contain & collect dry & volatile matters in  
sublimation. The upper one is closed in the upper part.

Sublimation is a process by which volatile &  
solid substances are obtained. When the products  
are in powder, they are called Flowers, & when  
in solid concretions, sublimate. It is conducted on the  
same principles as distillation.

The vessels used to contain substances that o-  
perate on each other are either Crucibles, or Iron  
Pots. This operation is called Cementation. It  
is used to separate Silver from Gold, convert Iron  
into Steel, & Copper into Brass. The plates  
of Metal are laid stratum super stratum & a  
powder called cement placed between each stratum.  
This powder is in the operation converted  
into Vapour.



Lect. 10. All the acids contain some water. The heat & effervescence occasioned by the mixture of one acid with another are owing to the water in y<sup>e</sup> acids. Vit. acid & Zinc form white Vit. With Iron, Cupperas, or Sal. Mart. with Copper Blue Vit. The air abounds with an acid, probably the acetous as it escapes from diff. fermenting substances. The Electric Effluvia is a pure uncom-pounded Principle of inflammability it is of an acid Nature, or compounded with the acetous acid in the air. It is never found pure but combined with 1<sup>st</sup> Phlogiston forming Sulphur. 2<sup>nd</sup> Trassile Alkali form. Glauber's Salt. Veget. Alkali, Tart. Vit. 3. Calcareous Earth, Selenites. clay, Alum. 4. Metals. principally Iron, Copper & Zinc. 5. Mineral waters. & lastly with wood. Sulphur is almost every where in the Earth, which, being decomposed produces by Volcanos or some such Natural Process produces the Vit. acid which is combined with diff. substances or was originally pure & combined with Phlogiston &c by diff. Processes.



The Vessels used in Solution, are,

Pelicans are glass alembics consisting of one piece. They have tubulated capitals from which two opposite & crooked beaks pass out & enter again at the belly of the cucurbit. It is used in Circulation. Two Matrasses with their necks inserted into each other, are now used instead of Pelicans.

Heat is applied & regulated by means of a Furnace. Which is a chemical instrument used for containing combustible matters by the burning of which, the heat requisite for operations is produced, & also for containing the substances themselves to which the Heat ought to be applied. They consist of 1. An Ash Pit communicating with the open air. 2. A place to contain the fuel, between which & the ash pit, are to be fixed Grates. 3. A hole or door for applying the fuel, & 4. A vent for the smoke. How many kinds of Furnaces are there? 1. The Lamp Furnace, Reverberatory Furnace, the Forge, Blast Wind or melting furnace, the Manor or Steegarot Furnace, Testing, cuppelling, or Mary Furnace. Muffles are coverings of such matters as are exposed to heat in an open fire. Their forms are various.



It is mostly obtained from <sup>men</sup> Vit. Sulph.  
& then for the Arts. fifteen parts of  
Sulph. contain fifteen of Vit. acid. Earthen  
Vessels well glazed are the best for decomposition  
during the Sulph. & getting Vit. acid. In the  
distillation water comes over first, then  
the acid. White clouds appearing show  
it carried far enough. Only 2. or three  
Pounds are got <sup>from</sup> a Pound of Sulph.  
The best process is per Cognacum.  
Nitro is added by Corn. Dreibel which  
makes the process succeed better, because  
the dephlogisticated air of which the  
Nitro contains a great quantity, being  
supplied the Sulph. combines with  
the Phlogiston, favour the Combustion &  
the separation of the Vit. acid. One quart  
of pure vital air only in the Atmosphere.  
Vit. acid volatil: only combines with Phlo-  
giston or Oil. Nitrous acid escapes in red  
fumes by exposure to the air. Aqua regia is  
a mixture of the Nitrous & Muricatic  
acids. It unites with all the acids & Alkalis  
producing heat & Effervescence. Nitrous  
acid combined with Fossile Alkali forms  
fusile Nitro; with Vegetable Alkali Nitro is



Lutes are substances used to close the openings or punctures of vessels, to prevent the escape of the matters they contain. When the matters are not corrosive, or the heat is gentle, we use Flour & Water spread on slips of paper, linned meal, or Bladder cut into slips, & moistened. When the heat is considerable, & the substances corrosive, we use a composition of Clay & Sand.

The red flaming colour of Sp. Nit. is owing to the quantity of Phlogiston it contains; by being exposed to the air, it becomes pale by the escape of Phlogiston. The colour is again renewed by adding more Phlogiston in Sp. Vin or Alcohol. It is procured by decomposition; by adding Vit. acid, which, by elective attraction forms Card. Vit. with the veg. alkali in the Nitr. The Muriatic acid is not added because the Nitrous acid & Veg. alkali have a greater attraction to each other. Nit. acid is very volatile. It generates a less degree of heat, when mixed with water than the Vit. acid, - but greater cold with Snow, or Ice. —



with Vol. Alkali, Nitrous Ammon; with  
Phlogiston eagerly, as appears from mixing  
it with Turpentine; with Earths & all the  
Metals but gold, tin & Antimony; it dis-  
solves tin & Antimony, but they soon subside  
in calces. It absorbs water powerfully from  
the air & becomes green by this union.

Its solution of Ice generates cold; mixture  
with water heats. It dissolves Animal &  
Vegetable substances like the Vit. acid.

It is always combined with foreign substan-  
ces naturally, & never obtained pure. It  
got chiefly from Sal. Nit. clay or Brick  
dust is mixed with it gen<sup>lly</sup> to admechan-  
ically only in dividing the particles &  
exposing them better to the action of the  
fire. 2<sup>nd</sup> by adding green Vit. in which a  
double elective attraction would happen be-  
the Vit. acid only attacks the Veg. Alkali  
& the Nit. acid escapes in red fumes, the  
Heat of the Furnace is so great as not to  
allow the Nit. acid to attack the Iron or Cu.  
3. By Vit. acid alone. In large works, only  
the clay or Brick dust is added to divide the particles.

The Nit. must be very well powdered or  
calined. One part of Vit. acid is added to two  
of Nit. The L. College direct it to three.

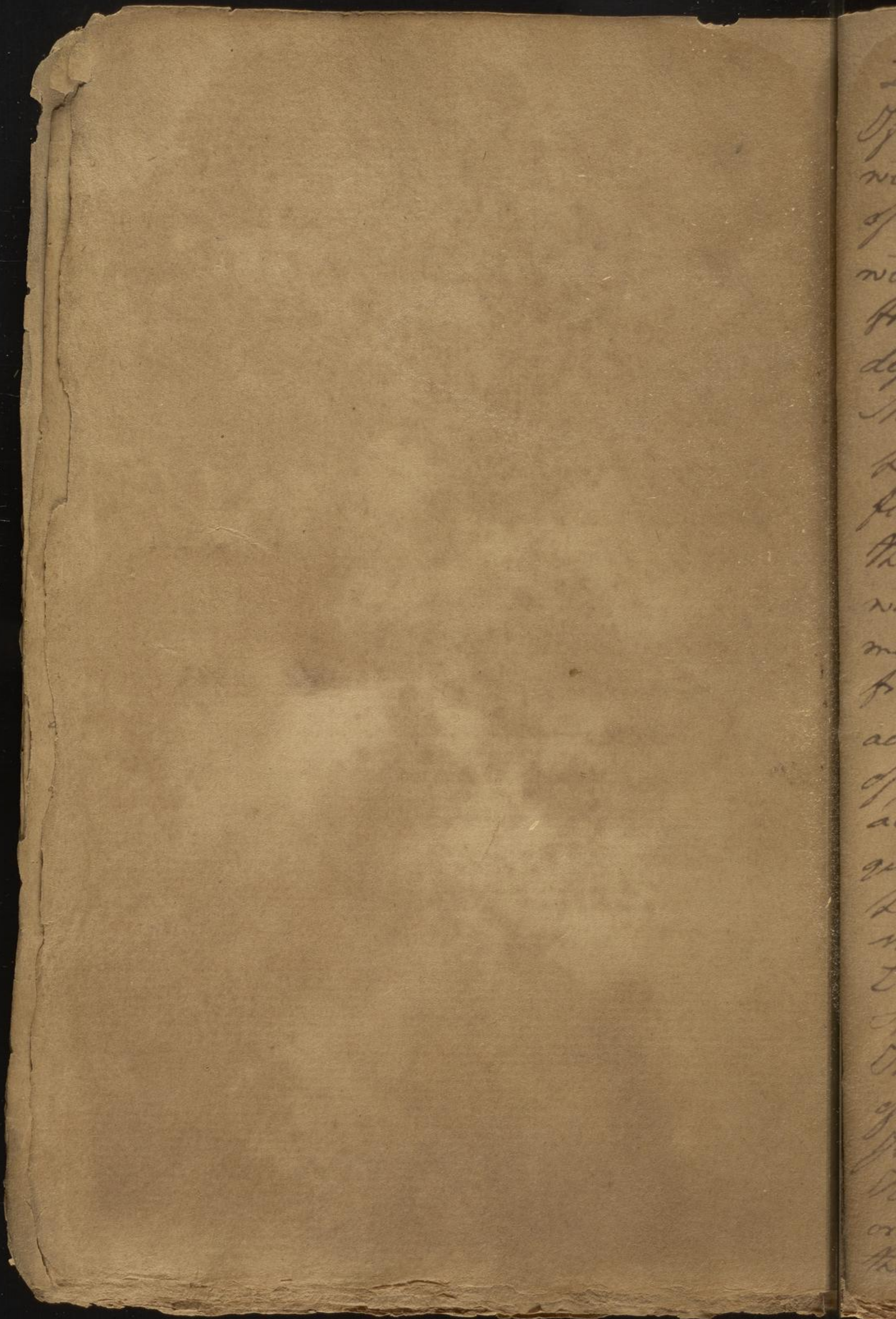


Muriatic acid is produced by decomposition; it may  
be obtained by adding either Nitrous or Nit. acid,  
on account of their greater attraction with the  
fossil alkali; but the Nit. acid is added gen-  
erally because it is cheapest. — Its specific gravity  
to water is as 10 to 12, i.e. the Nit. acid.



The vapours are very penetrating & corrosive.  
They often break the vessels & dissipate the  
Lutes. The best way is to partly fill the  
Receiver with water, in which they are  
confined; as Woulfe does, by fixing several  
Receivers. Muriatic acid is always  
mixed with it. Coagulation is practised  
to concentrate & strengthen the acid  
by distilling it again. Marine acid is  
discovered in Vit. acid by adding a solution  
of Silver in Nitrous acid; the Muriatic acid pre-  
cipitating it. Marine acid is neither volatile  
like as the Nitricus, nor heavy as the Vit. acid.  
Its specific gravity is as 12 to 10. The  
Muriatic acid combines with 1. all alkalis  
2. Calcareous Earth form Sal. Ammoniac  
3. an earthy salt. 4. the acid. 5. Phlogis-  
tic or oily matters very badly; 6. Ardent  
Spirits, making Muriatic Ether. 7. with water with much heat. 8. Animal  
& Vegetable matters, but don't turn black.  
It is obtained chiefly from common Salt  
1 by adding Earth or Sand, 2. Nit. acid. 3. the  
Metallic compounds, as green Vit. & Sal  
Ammoniac, distilled together produce Chlor  
Mar. 4. Vit. acid pure. It is preserved from  
mixing with Muriat. acid by adding Calcar-  
eous Earth. It is yellow fumes arise







Lect. 11. *Starry acid* is a mineral acid.  
If pure it's obtained in vapours, <sup>by distillation</sup> & is mixed  
with water. If concentrated it is in the form  
of air. It's a modification of the Marine acid  
with calcareous or ~~siliceous~~ <sup>starry</sup> earth. It's obtained  
from *Starr*; it's the most powerful acid. It  
dissolves the silicious Earths, Glass, all the  
Metals; animal substances, & combines  
powerfully with water. It extinguishes  
flame, has a very penetrating smell, corrodes  
the skin & kills animals. When mixed with  
water a great heat is produced & a white sedi-  
ment is deposited. It's obtained by distillation  
from the water with which it's mixed. Vegetable  
acids possess most of the distinguishing properties  
of Mineral acids; but not so powerful. Native  
acid is obtained by expression, & contains a  
quantity of gross mucilaginous matter, which it  
loses with on the application of gentle heat. It  
should be gradual as it's apt to acquire an  
Empyreumatic Taste & odour from fire.  
It's mixed with water to prevent it's fermenting.  
It should be gently evaporated to the consistence  
of Syrup, that Rob is prepared from Lemon  
juice. It unites with all the alkalis producing  
that effervescence. It don't attract Phlogiston  
or Animal substances. It unites with & dissolves  
the absorbent Earths.



Radical or concentrated Vinegar is totally inflammable.



It dissolves Iron, Copper & Lead, united with water. It exists in greatest abundance in all the Fruits, particularly before they are ripe, as then it is not so perceptible on account of its being enveloped in the Sugar & Oil.

Wood Sorrell is the only plant that yields it in a Crystalline form. From 100 of Wood Sorrell, 106 of acid have been procured, which yielded 3ij. 3ij 3ij of pure Native acid.

The Fermented Acids are Vinegar & Tartar.

Vinegar is always diluted with a great quan-

tity of water. It is concentrated by distillation;

but most perfectly by exposing it to 12° of heat

below 32° of F. Thermometer; in this the water is

frozen & the remainder is the pure acid, as foreign

and & corroding as the Mineral acids. It

unites readily with all the alkalis; with the

fixed it makes Tart. Regenerated. the Vegetable

Sal. Diversed. the Vol. alkali, & Minder.

It don't attract & coagulate; but dissolves the

Calcareous Earths. It corrodes & extracts the

virtues of <sup>uniting</sup>  $\text{O}_2$  with  $\text{S}$ , with Antimony, & ex-

tracts an emetic quality from it, with Zinc,

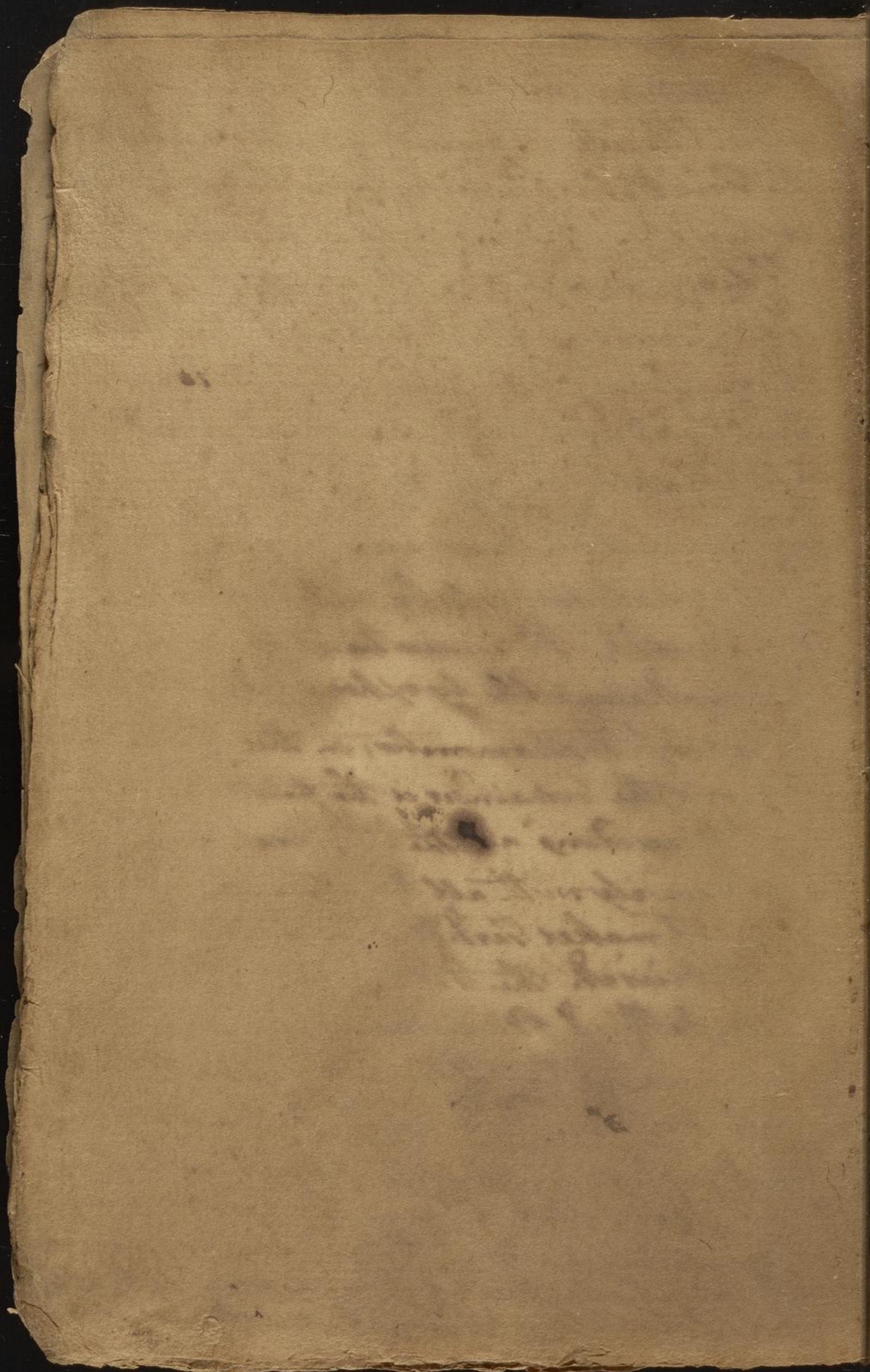
& with  $\text{Fe}$ ; & Copper. It may be separated from

these metals by Heat & Elective Attractions;

but not entirely except from Lead. It attracts

Water, Vegetable & Animal substances, slightly

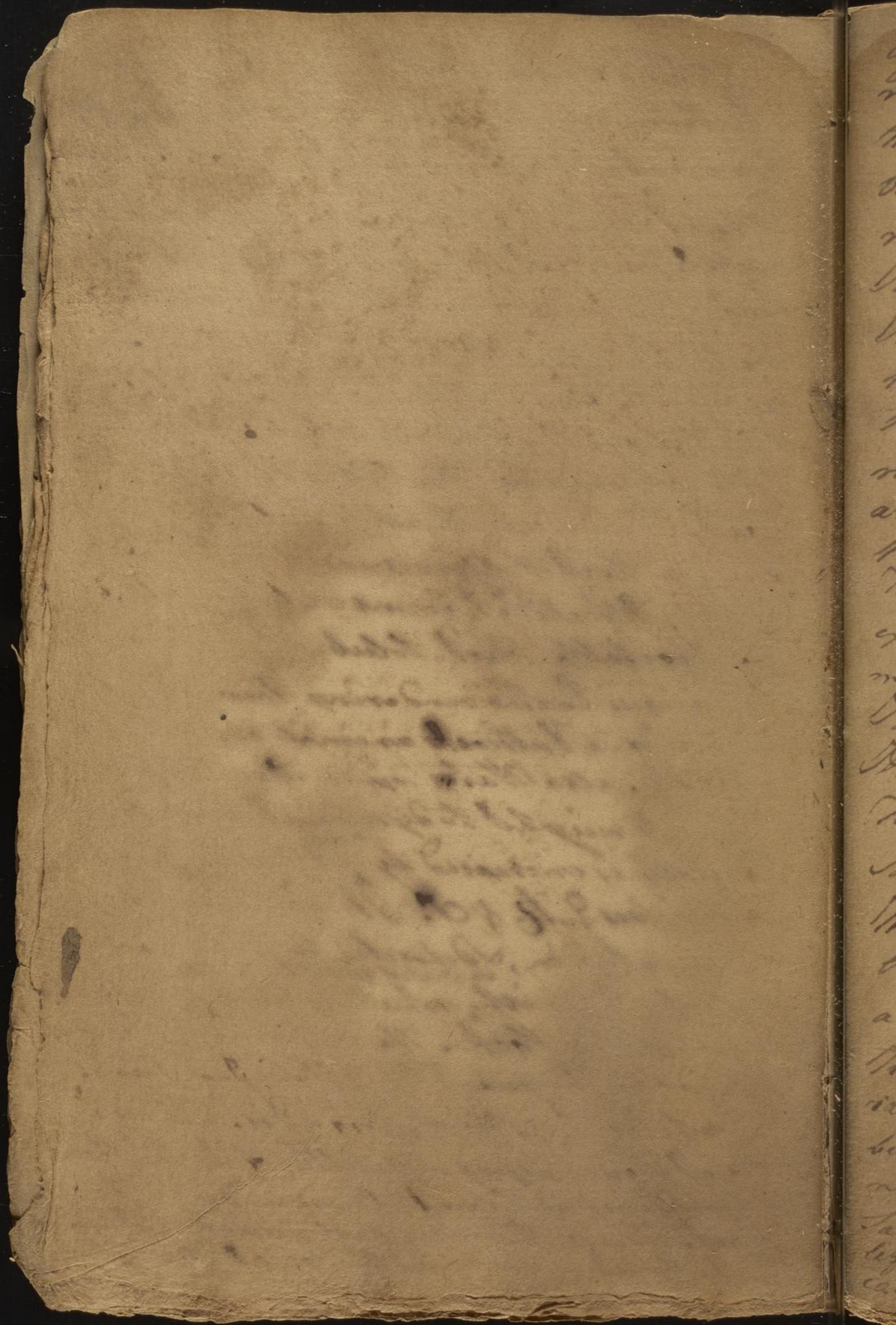






excepting Squills with which it forms  
Acutum Scillitum. This produced by  
fermentation from sweet vegetable juices.  
TARTAR differs from Vinagre in not being dissolved  
in sp. Vin. not forming Sacchar. sat. with  
Lead, & in not forming the same Neutrals  
with the same Alkalis. It is obtained in  
a concrete form combined with Oil; by  
distillation it affords an alkali: It is decom-  
posed by Vinagre; the Oil is dissipated by  
Heat. It unites with all the alkalis pro-  
ducing Heat & effervescence; with the  
fixed Alkali, it forms Sal. Russell. &  
the Vegetable Tart. Solub. It unites with  
Calcareous Earths rendering them soluble  
in water. It attracts animal substances  
slightly; also Water since it requires 24  
times its weight to dissolve it. Its sol-  
ubility is increased by <sup>Boiling</sup> Alkalis & Earths.  
It dissolves F. N. & O. It is the product of  
Fermentation, & deposited by Wine parti-  
cularly Rhenish, which after this deposition  
is called Old Hock. The difference in colour  
depends on the quantity of oil it contains.  
The whiter it is, the purer it is. The rich  
sweet Wines afford very little of it; the thin  
& poor Wines as Clare, Burgundy &c the  
most. Hence they are particularly improper  
in the Good on account the great quantity







of acid they contain which is sedative as  
well as all other kinds. They, by debilitating  
the system & acting sedatively, assist in  
bringing on the Gout, for which reason, the  
rich sweet Wines are preferable in this disease.  
It is not used in Medicine in its crude state.  
It is prepared by dissolving it in water, eva-  
porating the solution & suffering it to crys-  
tallize. This is the best method, & practiced  
most at Montpellier. The Distilled acids  
are very weak & have fewer of the common  
properties of acids than the expressed & fermented.  
They exist formally in Vegetables, but can't be  
extracted except by distillation, whereas the others  
may be obtained by expression & fermentation.  
It is obtained from Amber, Tar, & the Fir trees.  
It is concentrated by distilling it. The virtues &  
Taste of Tar water depend on this acid. The  
Animal Mills are the Acid of Ants, of Bees,  
Wasps & the acid of Urine or the Basis of  
Phosphorus. Acids in general are originally  
a Product of Nature. Acid of Ants is concen-  
trated by Heat, but care is requisite as it gene-  
rally acquires an Empyreumatic taste, com-  
bined with the fix<sup>d</sup> alkali it forms a long crystal  
with Vol<sup>l</sup> Alkali it forms a deliquescent  
salt; it dissolves all calcareous earths, which may state  
lize; it does not attract Phlogiston; it dissolves the  
calces of Silver & Copper.

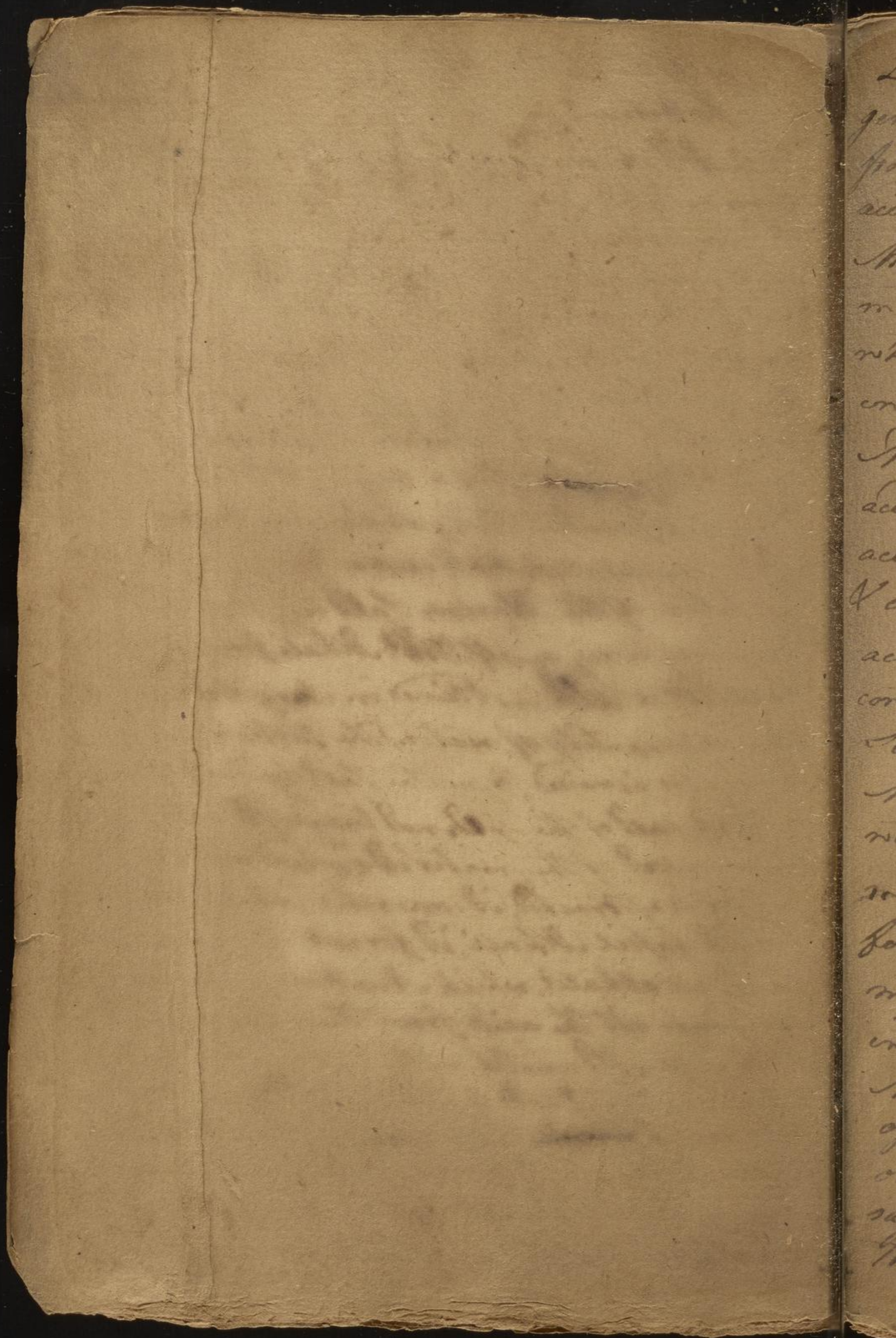


It dissolves Iron filings with violence, but don't  
act on its calces. It dissolves the calces of lead tho  
it don't act on it in its metallic state. It dissolves  
Zinc violently. It don't act on Antimony or  
Bismuth. It's found in the Urine in small  
bags. It's volatile, as proved from stirring an  
Iron ball in Summer or Spring; a small pro-  
ceeds from it similar to that of Sal. Armon.  
Vol. The acid of Bees & Wasps is similar to it,  
& they are all obtained by distilling <sup>in</sup> Water.  
The pain occasioned by these things is from the acid  
emitted. Acid of Phosphorus, is native,  
exists in a combined state & is obtained in a solid  
form, by decomposition, from the Urine of all  
Animals. It unites with Veg. alkali & forms  
oblong crystals. It's naturally united to <sup>the</sup> Vol.  
alkali from which it's separated by gentle heat;  
it has a great attraction for all Alkalies. It decom-  
poses common salt & Vard. Vit. & unite with their  
Bases. It unites with Earths & strongly attracts Phlogis-  
t with which latter it makes Phosphorus. It readily  
burns with its Phlogiston to the air. The Light &  
Heat of Phosphorus are owing to the ~~the~~ gradually  
escaping. It dissolves Zinc, Cobalt, & Iron, & dissolves  
in water. Cong. 20 of Urine yields 34 of this salt. It's  
probably a vegetable salt as it's found in greatest  
abundance in animals & so feed on Vegetables. The  
predominance of Vol. Alkali in the system, is the  
proximate cause of Scurvy & this occasions a resolved



state of the solids, but one degree above Putrefaction  
& a putrescent state of the fluids. The Vol. Alkal.  
exists ~~materially~~ <sup>materially</sup> in blood is evolved by  
fermentation, and always is during putrefaction of  
Animals; but it's neutralized by an acid existing  
materially in the Body taken in by the food, where  
by it don't prove pernicious, & is thrown out of the  
body & by its various outlets. Particularly by Urine.  
The vegetables taken to cure the Scurvy by affording  
a quantity of acid <sup>in a material state</sup> saturate & neutralize the alkali  
as far as possible. By a long continuance of salt food  
& the perspiration being obstructed. — But the Vol.  
Alk. is accumulated & causes Scurvy. There is a trans-  
mutation of the Marine salt into Vol. Alkali.  
The Phosphoric acid & Vol. Alkali form Sal. Armoniacum  
Sedative salt is obtained in crystals, which con-  
tain a quantity of water. The taste is bitter & sour.  
The water is raised from the salt by Heat, & carries up  
with it part of the salt, not because it's volatile, but  
on account of the water it's mixed with. After the  
water is extracted, it concretes into a solid Mass.  
With fossil Alkali, it forms Borax. It unites  
with all alkalis, which Neutrals crystallize. It  
dislodges all the acids from their Bases, but the  
Vitriolic. It unites with Calcareous & Argilla-  
ceous Earths; it acts feebly on Inflammables & Metals,  
& dissolves ~~feebly~~ slowly in water. It's obtained  
from Borax by decomposition, by distilling it with  
any of the Mineral acids.  
Phosphoric acid & Vol. Alkali form Sal. Animale.

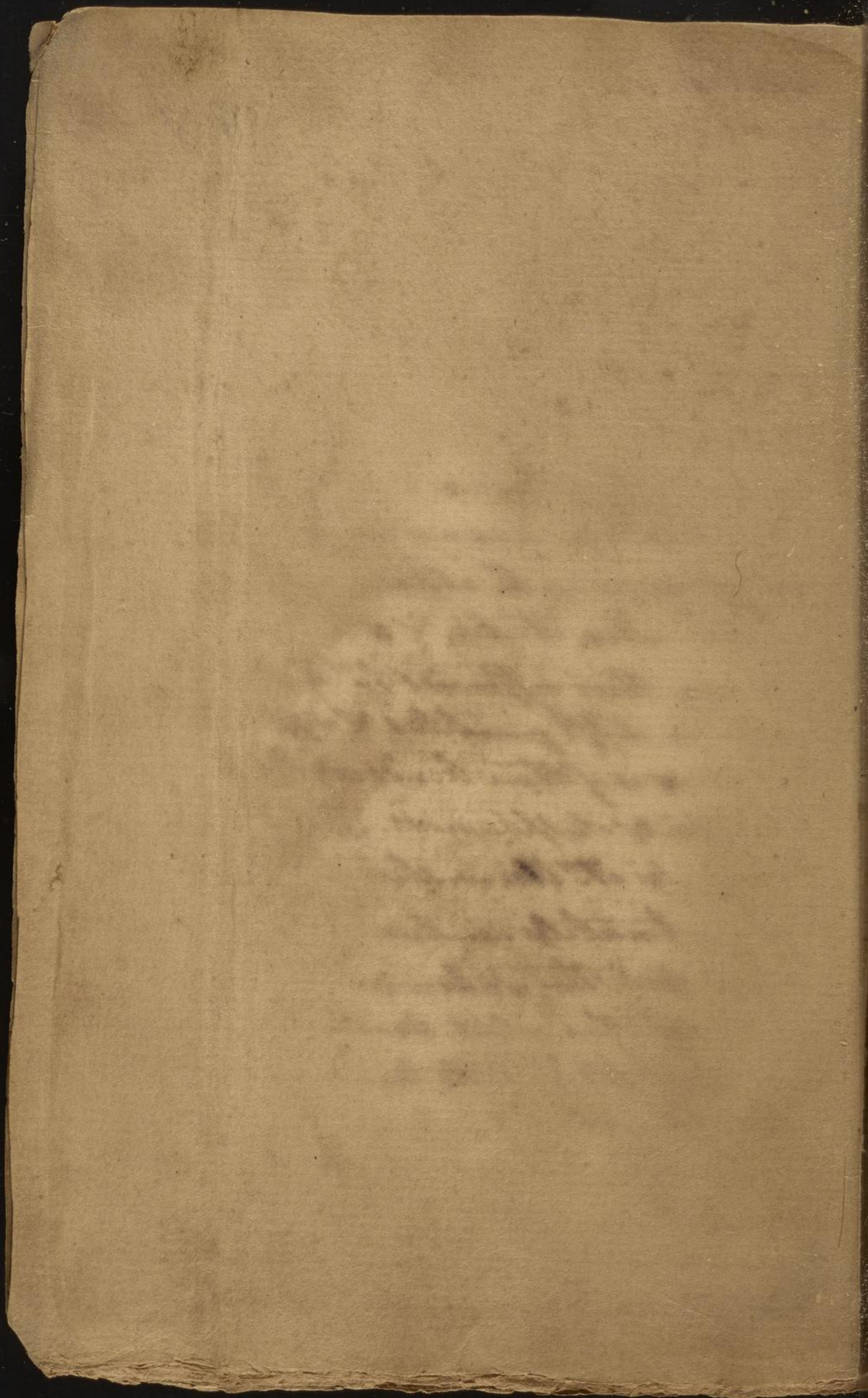






Lect. 12<sup>th</sup>. Acid of Sugar is a vegetable acid sui  
generis, obtained from all Saccharine Plants;  
from Sugar cane by distilling it with Nitrous  
acid. The Sugar Cane yields the most, the Beet,  
Maple &c. afford some. It combines very inti-  
mately with Lime & yields it to no acid  
whatever. Besides the Mineral acids already  
enumerated, there are the acid of Arsenic, of  
Antimony, Molybdena & Tungstic<sup>acid</sup>. The  
acid of Milk also is among the Vegetable. All  
acids effervesce with alkalis, turn Syr. Colored  
& contain Air, Water, & Phlogiston. All the  
acids owe their differ<sup>ences</sup> to the Phlogiston they  
contain in diff. quantities & diff. combined.  
Sulphur is of three kinds viz. Returvenous,  
Metallic & Sulphureous. Acid differs from  
water only in the constituent parts being  
more intimately combined. Sulphur has been  
formed from the Nitrous acid & Turpentine  
mixed together, which proves that it is converted  
into the Vit. acid, & the transmutation of acids.  
All the different acids are only modifications  
of one Primogenial acid, & its varieties are  
owing to adventitious substances. Boerhaave  
says all acids are powerful astringents, &  
that they act by coagulating the blood. But





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This is evidently erroneous, as the blood if co-  
agulated in the minute branches of the  
Pulmonary & Carotid Arteries would cause  
instant Death; moreover, by their stimulus  
they irritate the sensible orifices of the  
Lacteals, by which means they are contracted  
& the admission of the acids entirely prevented;  
in the Prime via also, the Bile destroys  
their acidity. Their action is confined to the  
Stomach alone, & is greater sedative; from  
which by consent of the nerves, their effects  
are communicated over the system. They  
are called coolers, but they produce this effect,  
by diminishing the action of the moving  
fibres & allaying the motions of the animal  
spirits. This is proved by a person drinking  
a gill of Vinegar, lowering his Pulse from  
80 odd to 60 in a very little time; & by it  
bringing on the cold fit of an intermittent.  
They don't act on the blood as antiseptics, but  
before they reach the blood by giving tone &  
elasticity to the moving fibres, upon which  
depends the crisis & health of the blood. In  
this manner they act in Putrid fever. The  
acid exists in the Sugar, materially not for-  
mally.



Cornwall.

If the use of Charges causes a great pain  
in the Breast; this is accounted for from this  
effect in lessening the diameter of the vessels  
in the by a free passage is denied to the fluids that  
used to pass that way, their impetus is increased, & con-  
sequently the consequence is



The Veg<sup>l</sup> acid blunted & sheathed, introduced ma-  
trially into the blood, neutralizes the Vol<sup>l</sup>  
alkali in the same state in the blood. They  
never enter the blood in a formal state. They  
act in Hemorrhages & fevers only on the smart  
in strengthening it & passing sedative by di-  
minishing the action of the solida vasa. The  
density of the blood is owing to the tone of the  
vessels. Of the ~~mineral~~ Mineral acids, the most  
commonly used, is the Vitriolic: the best form  
of it is the Eliz<sup>l</sup> Vitriol, in whose composition  
there should be much more of the aromatic  
than the bitter, as bitters & acid destroy each  
other. Eliz<sup>l</sup> Vit<sup>l</sup> is made much better, by the  
addition of Saffron, which is very Aromatic.  
Nitrous & Muratic acid irritate & excite  
coughing. The vegetable acids are most com-  
monly used. The best & most agreeable mode  
of giving them is in Oranges, Grapes &c.  
because they are rendered more palatable &  
less stimulant by the quantity of Sacchar.  
& mucilage they are wrapped in. I have far  
advanced in the P<sup>l</sup>th<sup>l</sup> Pulm. had her life  
prolonged 4 years by constantly eating  
Oranges. Dr. Moore mentions it being cured  
by Grapes. They exert their beneficial effects  
by inducing a tonic state of the vessels of



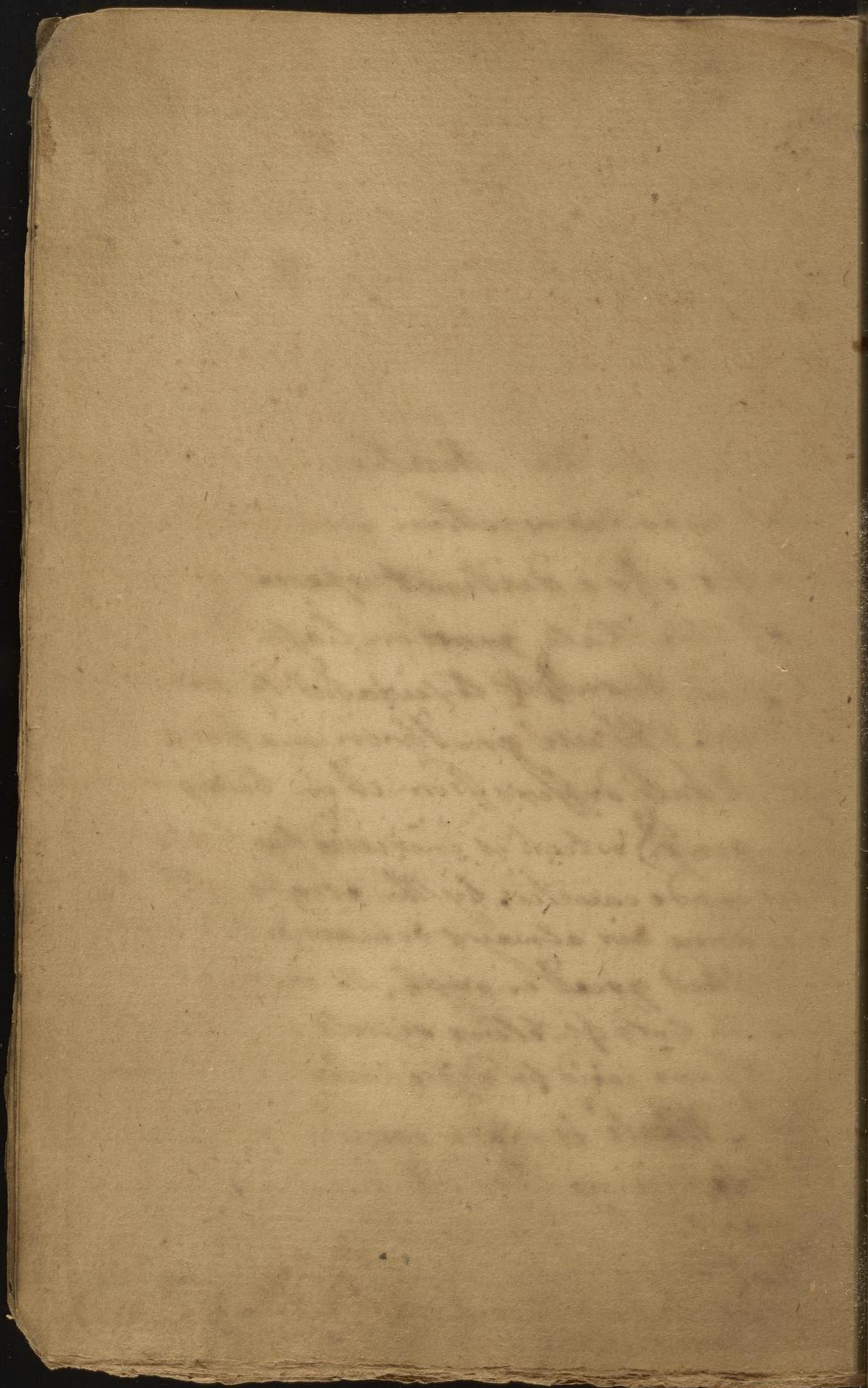
The Lungs, a want of which generally ac-  
companies this Disorder. In an Ulcerated  
state of the Lungs, there is both Debility  
& Inflammation, as well in the vessels of  
the Lungs as in the system in General;  
& the nature Vegetable acid, by strengthening  
the vessels assists Nature in expelling  
the offending cause & restoring the system  
to its former healthy state. With this view  
the acid of Tar & Tar water are good. All  
the preparations of Tar depend on this acid &  
their subtle purg'd Oil for their virtues.  
Stimulants are good Tonics; thus Sp.  
Tereb. the most pungent & subtle of all the  
Essential Oils, is of great service in relax-  
ation & Debility, as a corroborant; but is  
dangerous in an Inflammatory Diathesis.  
Alkalis are distinguished by the following  
properties viz. A strong pungent <sup>winous</sup> taste; they  
strike a green colour with Syr. Viol; they  
are detergent in cleansing the sordes from  
diff. parts; effervesce with acids; unite with  
Earths, & Metals; & are dissipated in vapour.  
It is dissolved in 6 times its weight of water.  
It is obtained by evaporation, & crystallizes in  
the form of a Lombar. It is found native in



the soil of Egypt, the bowels of the Earth,  
in Mineral waters. It deflagrates with  
Charcoal; whose vapour uniting with  
the Vit. acid forms Sulphur; which combined  
with the fixed alkali forms Neph. Sulph.  
the Veg. acid decomposes it. It is got artificially  
from Kali or Kelp which grows in great  
abundance on the coast of Spain & Italy  
bordering on the Mediterranean. Bucha-  
mel, who has written well on this subject,  
thinks it's a distinct species from the  
Veg. The Kali grows on Cape Henlopen.  
It is dried, burnt & lexiviated, to produce the  
Alkali. It is used greatly in making Glass.  
Veg. Alkali differs from it in being more  
luculent, which is increased by burning;  
thus made caustic, by the escape of the fixed  
air; some air always remains. The heat can't  
be applied great enough, to dissipate all the  
air. The Gold & Silver vessels would melt before  
all the air could be dissipated.

Veg. Alkali is made caustic by burning  
it & depriving it of its fixed air, which is  
always left in a fixed ratio to its causticity.  
It is obtained from Vegetables by incineration,  
by dissolving their ashes, filtering &  
evaporating the solution.



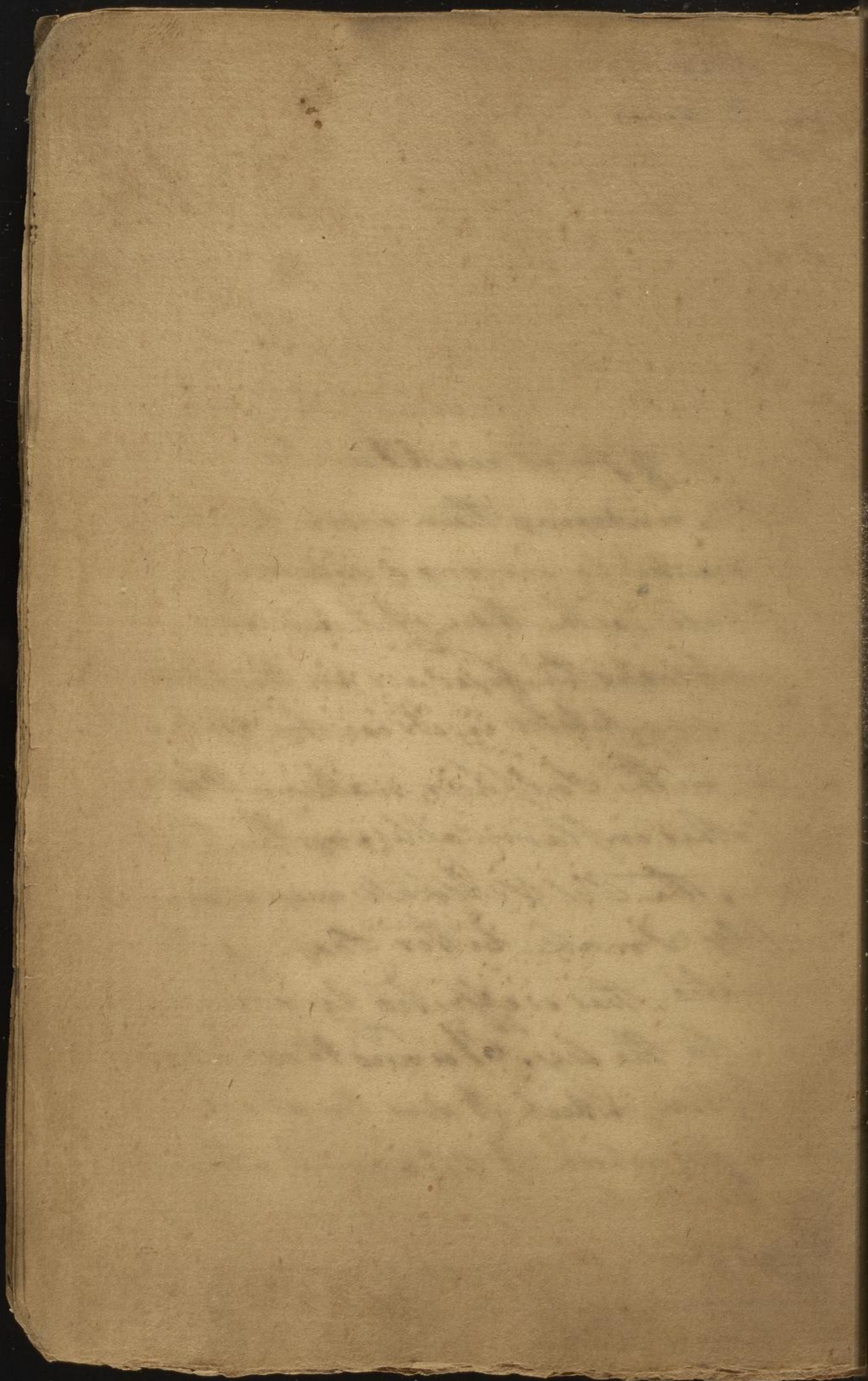




Lecture 13<sup>th</sup>

The effervescence of Alkali with Acids depends on the ~~gaseous~~ escape of the fixed air in the Alkali; therefore caustic alkalis don't effervesce with acids. Single Electric Attraction takes place in the mixture of Sal. Tart. with V. acid, the acid seizing on the alkali & the air escaping, by which their weight is considerably diminished. Sal. Tart. 3ss contains 3j of fixed air. Unites with the Earths, rendering them more fusible. It is made caustic by mixing a solution of 6 parts of Alkali with three of Quicklime, the Quicklime absorbs the fixed air in the Alkali, which precipitates in its caustic state. It unites with Sulphur, making Hep. ar. Sulphur. ar; & other inflammables; with Oils making Soap; the Oil & Alkali mix more intimately & make better Soap, if the alkali is caustic, this is effected by adding Quicklime to the ley. It is used to dephlegmate S. P. Vin. which it does by absorbing its water for which it has a great attraction, so great as to turn liquid if exposed to the air. It dissolves in an equal quantity of water. It combines with no Metals but ~~the~~ being Metallic state.







It promotes the fusion of Metals, but most ef-  
fectually in their state of Ore; because Sulphur  
mostly enters into their composition, ~~and~~ with  
which it forms an Apat. the bed of all fluxes.  
In its caustic state, it corrodes & destroys Vegeta-  
ble & Animal substances. It removes Films  
from the Eyes having a much greater attraction  
for inorganic than organic bodies; dissolves  
Mucus hence used in Gonorrhea in its first  
stage; dissolves Oeuginous Particles, hence used  
in Bleaching, as the colour of unbleached linen  
is owing to the foreign Oeuginous particles  
which tinge it. Gold & Silver are obtained from  
Red Silks with which they are interwoven, by  
throwing them into a solution of caustic Alkali  
which dissolves the Silk being an animal  
substance, & suffers the Gold & Silver to pre-  
cipitate. It is obtained by deflagrating Nitre  
with Charcoal; by calcining Tartar; & from  
the ashes of Vegetables. Vol. Alkali has all the  
characters of the fixed or mixture with the acid; it  
dissipates in vapour with a degree of heat far below  
that necessary for its fusion; it is more caustic than  
fixed. Its mildness depends on the presence of fixed  
air & its causticity on the absence of it. —



Unites with the acids making different kind  
of Ammoniacal Salts; with the fermented  
acid making *Sp. Minderer*. Nitrous Ammon.  
exposed to Heat, makes a great explosion. It  
unites with Earthy substances slightly; with  
Essential Oils; Can be taken <sup>with water</sup>; with *Sp. Vin.*; with  
Sulphur making *Hepar Sulphuris*; with Me-  
tals, dissolving Copper at instances in *Cuprum*  
*Ammoniacum*. It dissolves in Water & crys-  
tallizes, generating cold on its Mixt. & heat on its  
caustic state. It is obtained from putrefying  
Animal substances; from the Hoofs, bones  
& other solid parts of animals <sup>& from Urine</sup> by distillation  
but chiefly from *Sal. Ammon.* Fixed Alka-  
lis, Calcareous Earth, & Metals decompose it.  
The proportion is *Sal. Ammon. ℥j.* & Potash *℥ss.*  
which are put into a Retort with a suitable  
quantity of Water & suffered to distil. The  
quantity of Vol. Alkali, will be greater than  
if the Fixed Alkali was perfectly caustic,  
because it absorbs & carries over the fixed air  
that the fixed alkali contained & was obliged to  
last with. There is only one Primogenial  
Alkali, all the others are modifications &  
varieties of the original one, owing to adven-  
titious substances.



The fossil Alkali; over its difference to  
Bitumen & other inflammables; & Vegetable  
to Phlogiston & Vegetable substances. Fixed  
Alkali can be changed into Volatile, as in  
Deflagrating Nitre with Charcoal; & in  
the conversion of the Marine alkali of the  
salt used with our food, into Vol. Alkali,  
causing the Scurvy. — It acts as a power-  
ful stimulus on the Solida viva; Hence  
has proved an effectual remedy in People  
poisoned by sedative vegetables; & in Peti-  
terial fevers on the same principle.

Caustic Alkali is a powerful remedy in  
Calculus complaints. They don't dissolve  
<sup>for they would be rendered as mild as the urine itself before they arrived</sup>  
the Calculi. Sir John Pringle is mistaken  
<sup>at the kidneys</sup>  
in drawing inferences from experiments out  
of the body; & Huxham, in supposing  
they induce a Dyscrasia of the blood by acting  
immediately upon it for these reasons viz.  
There is an acid always in the Stomach, which  
must neutralize the Vol. Alkali as soon it  
is received into the Stomach; they can't enter the  
Lactals on account of their stimulus & the  
sensibility of the orifices of the Lactals.  
Vegetable Element generates more calculus  
than Animal abstracted from Intemperance & the food.



Their modes of action in relieving Calculous disorders are reduced to three Heads. 1<sup>st</sup> They supply the defect of Alkali in the system, to which perhaps may be partly owing the generation of Calculus; 2<sup>nd</sup> They change the state of the Urine, thereby enabling it more readily to dissolve the stone; 3<sup>rd</sup> They destroy or rather diminish the sensibility of the bladder.

Neutral Salts are composed of two simple salts, an acid & Alkali forming a certain quiddity, not partaking of the nature of either of them; in a certain determination <sup>to the point of saturation.</sup> proportion. The ceasing of effervescence is no criterion of Saturation; it depends on 1. The causticity of the Alkali; 2. Figure of the vessel; 3. Agitation & distance of the particles from each other. The best way to determine it is by dipping a Paper in Syr. Viol. & immersing it in the mixture; or by taste. Neutrals made with the Vol. Alkali should be excluded from the air, because the Vol. Alkali will escape. The Natural Neutrals possess 1<sup>st</sup> less acrimony, 2<sup>nd</sup> less Plogiston. They unite with no Metals, but freely with water.



They can be disunited & again united, without altering their properties. Elective

Attraction depends on Heat. —

There can be but 18 compound Salts formed out of the 9 simple ones, owing to ones decomposing another by elective attraction.

Let <sup>us</sup> Dr. Glauber's Salt is a compound of the Vitriolic acid & Fossil Alkali. Its crystals are pyramidal with two acute & two obtuse angles. It's spontaneous calcination on exposure to the air is a mark of its purity. It contains a great deal of water & undergoes a watery fusion by Heat. It's unchanged by Acids & Alkalis, & has no effect on Earthy substances. It's decomposed by Charcoal, the Vit. acid & Phlogiston forming Sulphur, which unites with the Fossil alkali & forms Phos. Sulph. This again is decomposed by the Vegetable acids which neutralize the alkali & let go the Sulph. This alkali is precipitated & thus we obtain the Fossil Alkali.



The crystals of Vit. Ammon are of an oblong flat  
shape. & remarkably regular.



Metals dissolved in any of the acids are  
precipitated by sal. Glauc. by double elective  
Attraction. It dissolves very readily in water.  
The crystals are transparent in proportion  
to the quantity of water they contain. It  
has no action on Vegetable or Animal bodies.  
It has an action on Iron, Copper, Lead, &c.  
It is seldom found Native, sometimes from  
Walls & Plants; but mostly artificially from  
sal. Common. Repellens. or Borax by  
adding Vit. acid. Tart. Vitell. is a compound  
of the Vit. acid & Vig. Alkali. It decom-  
posed & exhibits the same Phenomena as  
sal. Glauc. with Charcoal. It does not act on  
Veg. or Animal bodies. Sixteen parts of water  
dissolve one of Tart. Vit. It is for the most  
part artificial. It is obtained in four different  
ways. 1. The acid & Alkali separate; 2. The acid  
separate, & Alkali compound; 3. The acid  
compound & the alkali simple; 4. both  
compound. It is seldom native from Plants.  
The 2<sup>nd</sup> is the best method. Vit. M. M. M. M.  
has a penetrating, pungent taste. It melts  
readily with little heat, & is very volatile; for when  
united with Metals & Earths & distilled, they rise



It is not acted on by the acids; acts very slightly  
on the earths; corrodes all the Metals; dissolves  
readily in water; & is always artificial, obtained  
as above & says. Cubic Nitre improperly  
so, as its crystals are not cubes. It is mostly  
artificial; a compound of Nitrous acid & fossil  
Alkali. The Nitrous acid, before it met with  
the fossil alkali, would meet with Bitu-  
minous & other inflammables & thus on account  
of its greater attraction for Phlogiston would  
be prevented from forming Cubic Nitre & also on  
account of the Nit. acid's greater attraction for fossil Al-  
kali. It is native in Virginia; & obtained in  
4 ways above mentioned. Common Nitre, a  
compound of Nitrous acid & Veg.<sup>e</sup> Alkali. Its  
crystals have six sides. The smoother & more  
polished they are, the purer they are. Its  
fusion is owing to the same as that of  
Metals. It is used as a flux to metals but  
the Veg.<sup>e</sup> Alkali only serves this purpose, & the  
Nitrous acid uniting with the Phlogiston  
of the Metals makes. It contains much  
Dephlog. air. viz. It yields 12000 cubic inches.  
It has a strong attraction for Phlogiston. It  
unites powerfully with Charcoal & Sulphur,  
causing a dephlogation which is owing to the  
attraction of the fixed air in the Charcoal.  
No sulphur is produced in this manner.



Nitre & Sulphur ~~decomposed~~ melted together  
form Sal. Polychroes. Part of the Nitrous  
acid is dissipated & the remainder is a  
compound of Nitre & the Sal. Sulphur.  
Nitre with less Sulphur forms Sal. Prunell.  
It never acts on inflammables, unless  
they are made red hot. There is a living prin-  
ciple or a kind of elementary fire that  
serves for the regeneration of the Vegetable  
Kingdom; but there is no such thing in  
Animal. Nitre is the Basis of all ex-  
ploding combinations; of which the prin-  
cipal is Powder. Gun Powder is a com-  
pound of Sulphur, Charcoal, & Nitre; its  
proportions are viz. 75 parts of Nitre, 15 1/2  
parts of Charcoal; & 9 1/2 parts of Sulphur.  
The Nitre should be as pure as possible, for  
the goodness of the Powder depends on it. Similarly  
the Charcoal should be from the lightest wood.  
The Union of the diff. parts should be as in-  
timate as possible. Glazed Powder is not so  
good as the unglazed. Charcoal is composed  
almost entirely of fixed air & Phlogiston.



The superfluous earth remaining after the explosion of good powder should be very fine. The explosion of it is owing to the escape of the fixed air from the Charcoal. The smell perceived after the explosion of powder is that of Nepar. Sulphur which remains afterwards; the more there is, of this the worse the Powder & vice versa; and shows the constituent parts not to be well incorporated. Pellet's Fulminans in explosion makes the most acute & sudden Noise of any thing in Nature; it is composed of 3 parts of Sulphur 2. of Nitre, & 1. of Sal. Tart. Its explosion is owing to the escape of the fixed air in the Sal. Tart. Nitre is dissolved in seven times its weight of water. It has little action on Vegetables; & greater on Animals, it gives them a red colour & preserves them from putrefaction. It has a great attraction for Phlogiston. Nature seldom produces it. It is native, in some Plants as Tobacco leaves, which yield it by putrefaction. It is a product of putrefaction. It is made in great abundance



at Patna a town in India, from the putrefying  
Offals of the town. It's sometimes  
found native adhering to Rocks, hence it's  
Name. It's made in Prussia & Germany by  
heaping Straw & Dung under Trees, &c.,  
which putrefying yield Nitre. It's made also  
from the rubbage of Pigeon Houses, Stables,  
the earth of common Cellars & in short every  
kind of putrid matter, by accumulating it in  
a heap, covering it up & suffering it to putrefy.  
The Nitre produced in this manner is very im-  
pure & adulterated with Common Salt; it must  
be dissolved in boiling water, filtered & evapo-  
rated; the Common Salt will chry stallize  
with a boiling heat, which must be carefully  
taken out as fast as chry stallized; the Nitre  
chry stallizes only by cold & Rest. This must  
be repeated three times to get the purest Nitre.  
Lime put by itself on clayey ground will  
ruin it forever, but mixed with Outbreeding  
Vegetables, especially those putrefaction, increases  
their fertilizing power, by evolving Nitre  
from them. — It melts in gentle heat, &  
evaporates wholly in great heat. Its deflagration is  
owing to violent attraction between Nit. acid & Alk.  
It will not deflagrate unless red hot.



Salts. Ammon is obtained in 4 ways as the  
others.

Ammon. Salts emit pungent fumes when mixed  
with a fixed alkali or Quick lime, which unites  
with the acid & expels the Vol. Alkali.

Vol. Ammon is contained in the juices of some  
plants & obtained by acid. The evaporation should  
be carried on slowly.

Sal. Common fuses with no loss & red heat.



Lect. 15. Nitrous Ammon is seldom  
obtained in Crystals. On exposure to heat  
it deliquesces. It dissolves in water. When  
thrown into the fire it causes a detonation. It  
has no remarkable attraction for inflammable  
bodies. Vit. acid & fixed Alkali decompose it.  
Its effects on Metals are the same with  
other Neutrals. It has no effect on Animal  
& Vegetable Matters, nor on Earths. Sal.  
Commun. decrepitates when thrown into  
fire. It is decomposed by the Vit. & fixed acids.  
Vessels are glazed by holding them over the  
vapours of Common Salt melting in the fire.  
It is frequently combined with Earth & Mag-  
nesia; but these are precipitated by the ad-  
dition of an Alkali; or the Vit. acid which  
latter uniting with the Earth forms Saline  
& with the Magnesia Epson Salt, which  
are precipitated, & the Sal. commun. is left  
in solution. Epson Salt is often combined  
with it, which is precipitated from a solution  
of Sal. Commun. by the addition of Alkali.  
By the addition of a saturated solution of  
Chalk with Nitrous acid to a solution of  
Sal. com. a double elective attraction takes  
place & a cubic Nitre, & Sal. Ammon. & fix are



produced; the latter falls to the bottom, &  
the former is held in solution, which is ob-  
served by crystallization. Some waters also  
decompose it, by which a quantity of  
earthy matters falls to the bottom. Its  
great deliquescence in the air is owing to the  
earthy matters it contains & is accounted for  
in the following manner. Sal. Corn. con-  
tains Vit. acid & Magnesia; & by the action  
of fire a double elective attraction takes  
place; a ~~fixed~~ Glauber's Salt, & Sal. ammon.  
is formed from the union of the Magnesia & Muri-  
atic acid; the deliquescence is owing to its  
great attraction of the latter for water.  
Sal. corn. has a slender attraction for Collogium,  
unites with Sal. Glau. dissolves in Sp.  
in. acts on Metals in their simple state.  
Luna Cornua is produced from a mixture  
of a solution of Sal. corn. in water, & of Silver  
in the Nitrous acid. It is used as a flux, but  
the fixed alkali does all the good. It  
dissolves in 4 times its weight of water.  
Its action on Vegetables is ripening, but  
great on animals. It is antiseptic; this quality  
is confined to solid bodies. It being septic  
in small quantities is accounted for in the



following manner: viz. Moisture is absolutely  
necessary for Petrification which can be done  
without fermentation; a large quantity of  
Salt by hardening the fibres of the Meat for-  
wards the evaporation & escape of the juices &  
enables the solid fibres to resist their action;  
but a small quantity hardens the fibres  
only a small distance below the surface, &  
thus confines the juices which ferment &  
Petrify; in this manner it proves septie.  
*Omnia Plena sunt Salis.* It is always  
found Native; in the bowels of the Earth  
in Poland, Hungary & the East Indies;  
It is of a brown colour. The Island of Ormus  
in the Persian Gulf is entirely of Salt,  
which serves for the foundation of their  
Houses. It is found in Springs, thence  
called Fountain Salt; in the greatest  
quantity in the Ocean; which differs great-  
ly in degree of Saltiness in diff<sup>t</sup> places;  
thus a Pound of the Sea water in the Baltic  
or in other places at the same distance from  
the Equator contains half an ounce of Salt;  
but a Pound of sea water under the Equa-  
tor or between the Tropics contains 3ij of  
Salt. This difference is owing to the greater  
evaporation that takes place in the hot lati-  
tudes, & the vast quantity of fresh water



supplied the Baltic &c. by the melting  
of the snow & ice. The aqueous parts  
alone are evaporated. The proportion  
of salt to fresh water is as 73 to 70. The  
sea water is preserved from putrefac-  
tion by its salt; It differs in degree of  
purity thus the water at a considerable  
depth from the surface is much  
purer than that at the top, owing to the  
filthy matters thrown off from Animals  
putrefying & in death, rising to the sur-  
face & contaminating it. Walking the  
bath daily in salt water preserves it from  
putrid disorders. Dew prevents Diseases.  
Gun Powder checks the spreading of  
putrid effluvia by the great quantity  
of dephlogisticated air discharged from  
the Nitre during its combustion. Must  
of all kinds destroy infection. By the  
decomposition of sal. com. by the Vitae  
a very antiseptic acid is easily & expeditiously  
procured. The Muriatic acid arising from  
a mixture of sal. com. & some water, &  
Vit. acid 3ijj. will be sufficient to supply  
a Room a whole Day. The water is added to  
the mixture by the lead it produces



with the Vit. acid. It should be frequently  
stirred. An elective attraction takes place  
& a Glauberi Salt is formed. The Morning  
& Evening Air are to be avoided upon an  
empty stomach particularly; a crust of  
Bread or an infusion of the bitter herbs  
in cold water should be taken always  
before going out in the Morning. Intem-  
perance & abstinence are to be equally avoided.  
Irritability is the consequence of the former &  
Many of the latter, both which dispose the body  
more readily to receive infection. Contagion  
acts primarily on the Nervous System. The  
superior stimulus of any disorder counteracts  
the noxious effects of contagion & prevents it  
acting; thus Gouty people escape contagious  
disorders often. The Parts of the body exposed  
to contagion should be covered with Oil; because  
It entangles the effluvia, closes the Pores & pre-  
vents its entrance; thus Soap boilers often es-  
cape the Plague &c. Infection & Contagion  
are different. The first is communicated by  
contact, & the breath only, but contagion at  
a great distance thro' the medium of the air.



The Plague is infectious, its effluvia are  
destroyed by mixture with the Atmos-  
phere. Hogs bit by Rattle Snakes often  
escape without injury by reason of the fat  
entangling the virus. Sweet Oil anointed  
on the Glans Penis is the best Prevention  
of the Venereal Disease. Sal. Comm. is  
obtained by 4 methods viz. 1. Congelation by  
which the aqueous parts are frozen & the saline  
remain at the bottom. 2. Evaporating the water  
by the Heat of the Sun. 3.<sup>rd</sup> By the Heat of  
Fire as is done in Scotland; Ox's blood is thrown  
in to clarify it, which it does by coagulating  
with the Heat, entangling the impurities,  
rising to the surface from whence it is removed.  
This is called Boiled Salt. Sal. Gem. yields  
Rock Salt. The third may be saturated by  
the absorption of the aqueous parts of sea water  
by immersing the body in it. Glacis Maria  
is the only substance known to precipitate  
Sal. com. which it does considerably. 4.<sup>th</sup> By  
evaporating the water by the exposure of its  
parts very much divided to a stream of air.  
Winds & tempests by agitating the sea &  
exposing a larger surface to the action of the



air, increases its evaporation & thus supplies  
fresh water when wanted. *Sal Digestivum*  
differs from *Sal. Com.* in the former is chrys-  
tall; in dissolving more readily in hot than  
in cold water; & in being artificial. It is obtained  
by Heat & mixture as *Sal. Com.*



Lect. 16. Sal. Ammon. is a composition  
of Muriatic acid & Vol. Alkali. It comes  
to us in concavo-convex cakes. Its convex surface  
is of a brown dirty colour, <sup>spongy</sup> its concave or concave  
surface is white, lustrous & smooth. It volatilizes  
on a degree of heat far below that of its fusion.  
It is not decomposed by heat, but is by the Vol.  
or Nitric acid, & by the fixed alkalis as in making  
Vol. Alkali. If Stone lime is added more Vol.  
Alkali. It is procured than if Quick lime  
is added by reason of the former containing  
much fixed air, which the latter is devoid of.  
When Nitric acid is added, care should be taken  
to confine the steams of both, lest they should  
prove pernicious to the operator. The heat should  
be lowered towards the end of the Process for  
fear of the Neutral Salt exploding. Cal-  
careous Earths powerfully decompose Sal.  
Ammon. It has little attraction for Phlogis-  
ton. Not less than 32 parts of Sp. Vini dis-  
solve one of Sal. Ammon. The Muriatic  
Acid, it contains, dissolves Silver, Copper,  
Iron, Zinc, Lead, & Mercury, & suffers the  
Vol. Alkali to escape. With the copper it  
forms Em Veris, & with Iron, Flor. Mart.



These are separated by solution without heat.  
Sal. Ammon mixed with water generates  
20° of cold. It deliquesces in moist air.

It derives its name from the temple of Japi-  
tes Ammon, in whose neighbourhood it was  
first made. It is not native as supposed by  
the Ancients, but always artificial. A  
little is sometimes found native near Volcanos.  
It is obtained from soot which contains Vol.  
Alkali; & from fuel in Egypt, which is the  
dung of Animals. This is sublimed into  
large glass Globes, at the top of which the salt  
concretes in Cakes & assumes the form it has  
when brought to us; the receivers are broken  
to get at the salt. There are several holes in  
the glass for the escape of the confined vapour.  
There is a Manufactory of it in Scotland near  
Edinburgh. It is obtained in four ways, as  
the other Neutrals, mutatis mutandis. Tart.  
Regnat. is decomposed by Heat & the three  
Mineral acids. It has no action on Earth. It  
dissolves in Sp. Vin & in Water. It has no  
action hardly on Metals; & is always artificial.  
Sp. Minder. is used to stop Vomiting, quiet  
Nausea & promote Diaphoresis. It acts in the  
two first cases by the fixed air disengaged from it



in the Stomach proving sedative.

Tart. Solub. or Tartarizatus. is made by throwing ℥j  
of Fixed Veg<sup>l</sup> Alkali into ℥3 of Crem. Tart. in a  
boiling solution.



D<sup>r</sup> Badmington judiciously gives <sup>the alkali & acid separate</sup> it in order  
that the Effervescence may go on in the  
Stomach. The following method is the best.  
Mix five grains of the vol. alkali with as  
much flour (to prevent its deliquescing) & add  
the conserv. Rosar. into a Bolus; which give  
as soon as may be; & immediately throw down  
upon it a Table Spoonful of a mixture of  
lime or Lemon juice diluted with Mind.  
water & sweetened with Sugar. The prepa-  
ration of M<sup>r</sup>. Merdos. or Veg<sup>l</sup>. Ammon. is better  
Heat. Gradual heat makes it thick like  
Syrup, which is used with success to dis-  
cuss tumors. It does not act remarkably on  
Earths or Metals; & is always artificial.  
Sal. Russell or de Sugrette from its Au-  
thors name is decomposed by intense Heat.  
Sal. Solub. is incapable of fusion; & is de-  
composed by Vinegar & the three Mineral  
acids: Hence by being decomposed by the acid  
in the Stomach frequently disappoints the  
Physician, in not proving purgative. It  
dissolves easily in water; & is artificial.  
Borax is in large, irregular, & transparent  
crystals. Great heat converts it into a glassy



state but don't alter its properties, as it  
may be dissolved in water, & crystallized;  
& the crystals have the same properties  
exactly that they had before. It decom-  
posed by the Vit. Nitrous, Muriatic & Ve-  
getable acids. It acts on the Earth & salts  
in softening them. It dissolves in Sp. S.  
thin by lead which afterwards burns with  
a fine green flame. It is used as a flux  
& in soldering. It dissolves in 30 times its  
weight of water. It is brought from the  
East Indies, & is prepared in Holland.  
It is artificial, & made from fad clay; fad sub-  
stances are placed on pipe clay, & suffered  
to remain together for years 1 or 2. in which  
time an acid is formed that corrodes the clay,  
thus Borax is formed impure. But how it is  
purified, we know not. — Large  
crystals are formed from its solu-  
tion in lime water, & small ones in  
simple water.

Tart. R. S. M. attracts water very strongly  
& deliquesces. Mixt. R. S. Virtues like M. S. M.  
It is more grateful to the stomach & M. S. M.



The Neutral Salts have been used as coolers;  
but improperly as some of them excrete heat on mix-  
ture with water, & the cold which they excrete is not  
durable but acquires a warmer temperature  
before they enter the body. Tart. M. & N. M. & P.  
is a sedative like the other neutrals, but  
they are all less so than the acids. It is absorbed  
into the circulation; & increases the peristaltic  
motion of the intestines without acrimony &  
irritation. It is bad in atony, & very useful in  
obstinate spasms of the intestines, as the  
various kinds of Colic. It proves diuretic  
without acting immediately on the kidneys.  
It is given with the Bark in Intermitting  
to advantage, both to obviate cramping,  
& abate the heat in the system. Sal.  
Glauc. is the first cathartic, very good in  
Bilious, malignant disorders; & conjoined  
with Manna in the Dysentery. Rhubarb  
is bad in Dysentery as it aptly by its stimulus  
to raise an inflammation & increase it when on,  
but the best in Diarrhoea. Epsom salt  
like Glauber's. Tart. Vit. has been of service  
in Rheumatism. Nitre is the best purgative.  
It is used in Gargle in Aphthae; but doubtful  
in Pleurisy &c. as by its stimulus it often



causes troublesome coughing. It is good in  
Hemoptoe of the passive kind. Hemoptoe  
is divided into Active & Passive. Ex-  
pects something if given in Clysters even.  
Sal. commun. good in clysters to open  
the bowels. It is a powerful antientic.  
Cullen calls an artificial Salt water with  
Succes in Scrophula. A teaspoonfull of  
it in substance by itself is given every  
Morning in Hemoptoe which is in reman-  
to a Table Spoon full & sometimes to  
give relief. It is the most nauseous & dis-  
agreeable Medicine. It is used in Inter-  
mittents to pave the way for the bark.  
Sal. Digestivum is inert. Tars. Regent. &  
Solub. are aspired but often disappointed  
as by being decomposed in the stomach.  
Minder. should be given in large  
doses as it is unless in the small doses  
generally given. Neutral Salts are  
improper in Hypochondriasis.



## Earths. Sect. 17<sup>th</sup>

They are <sup>very fixed</sup> bodies which are not soluble in Water, are uncombustible, incapable of being fused, but are vitrified by a great heat.

They are divided into 1. ~~Stony~~ or calcareous. 2. Gypsaceous. 3. Argillaceous or Clays. 4. Flint or Vitreous Earths. 5. Talcky or Spheryous Earths.

The ~~Stones~~ are inclined & do not lie horizontally. This projection is called ~~up~~ rising. Stones & lighter substances lie uppermost, & the Metals deeper down.

The Hills observed in Mountains, in the bowels of the Earth & every where, are a mark of the Earth having undergone a great revolution, by the Deluge.

Before the Deluge, the plane of the Equator coincided with that of the Orbit, but after & by the Deluge it inclined in an angle of  $23\frac{1}{2}^{\circ}$ . Vegetables have a Principle of life. Minerals have not & grow entirely by accretion.



Absorbent Earths effervesce with acids. Some are soft & friable like chalk, others hard; some are transparent like chrys. tell. others are opaque like common earth. They differ from all others in <sup>the</sup> effervescence. Native lime is called Stone lime, it becomes quick by burning which greatly changes it. It loses one third sometimes one half of its weight by burning which deprives it of its fixed air & thus makes it caustic or Quick. 2. Lime corrodes animal bodies, this is owing to its powerfully attracting their fixed air. It unites with Vit. Acid with great Violence. The effervescence is owing to the escape of the fixed air by which it becomes much lighter. It unites with the Vit. Marine & Veg. acids feebly, in its native state. By adding caustic alkali to it, it loses its causticity & becomes mild by absorbing the fixed air from the Stone or native lime. But by adding mild alkali no alter<sup>n</sup> is produced. Sal. Ammon. is the only neutral with which lime unites. It is often united with clays. It is used greatly in the Chemical arts. Mortar is made of lime



maintained with water, & to prevent its  
great contraction (which would materially  
injure the building, sand is added.  
All calcareous earths assist in vitre-  
fying clays. Native lime acts feebly  
on Animal, Vegetable, & M. S. &  
weakly attracts Phlogiston. Q. Lime  
unites with all the acids & is very cor-  
rosive, but soon loses its acrimony by  
mixing it with fixed alkali. It is used  
as a Potential caustic. By adding it to  
Sal. Ammon. the vol. Alkali is expelled  
& a Sal. ammon. fix remains or what  
Mr. calls liquid shell from its  
disposition to deliquesce, & because he got  
his lime from shells calcined. It unites with  
Sulphur & Oils. Its action on the metals  
is little different from y of the native. It  
unites with water violently, & becomes  
slaked. Lime water exhibits all the  
Phenomena of an alkali, it is colourless  
& without odour. One ounce of water dis-  
solves but one grain of lime. Lime water  
exposed to the air has a pellicle formed on  
its surface occasioned by the lime's absorbing  
& fixing Atmosph. air & thus rendered insol-  
ble. Quick lime becomes stone lime by ex-  
posure to the air & absorbing & fixing it. It  
is preserved from its caustic state by mixing  
it with a fat. It is quickened by fire



It is used in refining Sugar. The Sugar is  
boiled with  $\frac{1}{4}$  its weight of lime, & is  
clarified by  $\frac{1}{2}$  its blood & the whites of  
eggs. After it is put into vessels, clay  
moistened with water is placed upon it  
which remains on it till it is dry, or a  
Day or two; the water dropping down thro  
the sugar, dissolves the earthy salt formed  
of the lime & the acid of sugar, & carries it  
out. The lime is added to neutralize the re-  
dundancy of acid that would prevent the su-  
gar's crystallizing. It should be kept in  
a Room heated 96°. Loaf sugar is made  
by boiling the syrup over again & clarify-  
ing it &c. The goodness of the Loaf sugar  
depends, 1<sup>st</sup> on the nature & quality of the  
Coarse sugar, 2<sup>nd</sup> the nature of the clay.  
3<sup>rd</sup> the nature & use of the clarifiers. 4<sup>th</sup>  
the number of times it is boiled. Double  
refined Loaf sugar is oftener boiled, clar-  
ified & clayed than the other kind. Cryst-  
tallization depends on the destruction of the  
acid. It acts powerfully on Animal & Vege-  
table bodies. It often mixes with Ani-  
mal bodies to accelerate their putrefaction;  
it hastens their reduction to their original  
principles by attracting their fixed air  
which enters into the composition & is the bond



of union of all bodies almost. It is used as a  
Manure which it is not in itself, but  
fertilizes the ground by causing an ex-  
traction of a manuring prin<sup>ce</sup> from the vege-  
tables it is mixed with. It is very pernicious  
if placed on clayey ground or any other with-  
out vegetables to act on, as it effect<sup>ly</sup> destroys  
the good quality of the ground, but mixed  
with vegetables it hastens their putre-  
faction & the generation of a saline or other  
Manure. Too much lime is hurtful.  
There should be neither more nor less than  
enough to act on the quant<sup>ty</sup> of vegetables  
it is mixed with. Forty Bushels is the  
quantity for an acre of common land,  
20 for an acre of poor, old worn out land.  
The more need & other vegetables, the more  
lime. A little dung helps it. Most hard  
Earths are divided into Chalk, Lime,  
Marle, Marble, calcined bones & the most  
Calculus, Sparks, Stalactites, Phy-  
tolithe, Zooliths, Tophi & Mag-  
nesia Alba. - Lime is found in the  
Earth & sometimes on the surface. Chalk  
is found in large quantities in Mountains.  
It is the primary earth, from which flint  
is formed. The difference of the colour is



owing to the animal & Vegetable substances with which it's mixed. Marble is composed of Lime, clay & sand. It is formed from its mixture with vit. acid. It is found in strata 50 or 60 feet deep. It's very fertilizing, which depends on the lime it contains. Marble lies in strata in the Earth; in Italy & the Island of Paros chiefly. It forms a Selenite with vit. acid with which it acts only in Powder. Iron is proved to be in the Marble from its striking an ink with a decoction of Galls. It's good deal formed from shells, which plainly appear from rubbing it with Oil. It's black, yellow, red, white & blue, mixed & figured. The best is in Paros an isle in the Levant. Sparth or calcareous earth, is found in a leafy, granulated, crystallized, or Rhomboid, & cubic.

Stalactites is in transparent crystals, & found in the hollows of Mountains, caves & caverns resembling icicles; formed by water washing together calcareous particles mingled in the parts of Mountains.



Phytolithe composed of Vegetables &  
stony matter. Petrifications of Vegetables.

Zoolithe composed of Animal matters &  
stony concretions. Bones of animals are  
calcareous. The chief is Human calculus.

Tophi is found in the joints of Gouty  
People; & is of consequence not a cause of

the Gout. Magnesia alba. is of a cal-  
careous Nature. It was formerly made

of the Mother of Nitre which is com-  
posed of the Nit. acid & calcareous earth; by

adding fixed alkali the Magnesia or calc.  
earth fell to the bottom & a cubic & com-

mon Nitre was formed acc. to y<sup>e</sup> kind of  
Alkali used. It is made from Bittern

after the crystallization of sal. com.  
It is also made from the Epsom Waters

in England or from a solution of sal.  
Epsom in water by adding an Alkali.

Lect. 19.<sup>th</sup> Magnesia differs from the other  
calcareous earths in being soluble in water. & in

forming a bitter, purgative salt with the Nit.  
acid. The others are astringent & insolub. in water.

Magnesia like Lime & Chalk becomes ligh-  
ter by being calcined in the fire; this change of

weight is owing to the loss of the fixed air.  
In this situation it does not effervesce with acids  
altho it unites equally intimately with them.



Lect. 19. M<sup>r</sup> Henry made this im-  
provement in Magnesia & this is reckoned  
the best; the calcined magnesia is better  
than the uncalcined as it don't gripe <sup>ch</sup> <sub>n</sub>  
the ~~latter~~ latter does owing probably to its  
fixed air. Experiments prove that Ashes  
contain calcareous earth, clay, & Magnesia.  
Those mostly used in medicine are, Chalk,  
Crabs eyes, calcined Hart's horn, & Lime water.  
The two first are most proper for acidities.  
They should be given in large doses of ʒij or ʒij.  
They are the best & only effectual medicines  
against Chronic diarrheas & disorders arising  
from acid. The third is insoluble in water,  
hence is only diffused in the Decoct. alb.  
Pringle ill judged from experiments out  
of the body that they are reptics in the body.  
They are harmless in the doses usually given.  
The virtues of Lime water are tried in cal-  
culous complaints. Its effects in these cases  
are attributed to its altering the state of  
the organs of secretion, or the nature of the  
Urine. By absorbing fixed air it becomes  
an inert salt which it can't fail of doing in  
the Stomach where there's always a quantity



of fixed air from the diff<sup>erent</sup> ferment<sup>ed</sup> matters  
& if not there, it would on coming in contact  
with the Urine which contains a great deal  
of it. D<sup>r</sup> Hales reasoning on the Human body  
as a Mechanical Machine that it acted by  
absorbing the fixed air in the calculus; but  
this is false. It given mixed with milk  
in Diarrhoeas but it absorbs it fixed air  
& becomes inert before it reaches the Stomach.  
The common notion of the Pilegm being full  
is ill founded since it can do no more  
hard than so much Calph<sup>er</sup> foot jelly or the like.  
Pilegm is not the cause but the effect  
of a weak stomach, & other disorders of the  
Viscus. Vomits frequently given are of service.  
The only use of warm water with Vomits  
is to make them work more easily; it should  
not be given in large quantities because it would  
overload the stomach & impede the Vomits op<sup>er</sup>  
ation; from 1/2 to 1/4 should be given. Sage  
Balm, Sage or Chamemile Tea will do to  
assist a Vomit if the Patient can take warm  
water. Bark, Steel, & other corroborants  
are the best medicines for Pilegm. Lime  
water is recommended by some on the princi  
ple of it cutting the Pilegm.



Gypsum Earth can be scraped with  
a knife, become liquid by great heat, &  
don't strike fire with steel. By dissolving  
it in water, <sup>after being burnt</sup> & afterwards drying it, it becomes  
very rare, & is converted into crystals. It seems  
to be a very close union of Vit. acid & calcareous  
earth. By Heat the Vit. acid is dissipated.  
Inflammable matters, Metals, acids, Alkalis,  
& Earths have no effect on it. It is found in a  
granulated form then called Alabaster, in  
crystals resembling those of Epsom Salt, in a  
fibrous form, a laminated form called Gla-  
ces Marbles Muscovy Tale which is very  
flexible, oblong crystals which is true  
Selenites. There is a gypsaceous spar also <sup>it</sup> is  
sometimes blue & sometimes white. At the  
bed of Marures, to answer which intention,  
it must be reduced to an impalpable powder  
& spread on the ground, in the proportion  
of 4 Bushels to an acre. Its effects are con-  
fined chiefly to grass; but it also fa-  
cilitates the growth of grains as corn &c. It  
acts like lime in hastening the putrefac-  
tion of the Vegetables, & evolving a salt for  
Manure proving fertilizing.



Clays are found in great abundance in every country, are of a soft nature, form a ductile soft paste with water, grow very hard by fire so as to sometimes strike fire with steel, & do not effervesce with acids.

Fire purifies all clays by dissipating the inflammable matters with which they are mixed. They are much used in making vessels in which case sand is added which hardens them more. Vit. acid is often mixed with it forming clay alum which bears the most intense heat without any considerable decomposition. Fire easily dissipates Vit. acid from the calcareous earths with which it is combined. Alum is easily decomposed by either Mineral or Vegetable Alkali, the Vit. acid & the former forms Sal. & carb., with the latter tart. Vit. & the clay is precipitated to the bottom. It used to decompose Nitre & Sal. com. the Nit. & Mariatic acids obtained in this manner are the best. Inflammable bodies & calcareous earths decompose it. Lime & Iron act on it. It dissolves in water merely by means of the Vit. acid; the most surprising & wonderful change. Alum purifies River water & precipitates its impurities, by the Vit. acid, which is not saturated as is evident from the taste, attracting & dissolving the vegetable & animal matters it is mixed with.



The water is made as clear as Rock water.  
It is used also to clarify Wines & Does it sur-  
prisingly quick. Clay or Sand is also often  
added with this view but they act mechan-  
ically whereas the Alum acts chemically.

Rock Alum is alum combined with Iron  
It is much more steeped & powerful than the  
other. It is found Native; & is got from Pyrites  
by Solution, Evaporation & Crystallization.

Nit<sup>r</sup> & Muriatic acid act on clays. Clays &  
Sulphur form Alum, <sup>Clay</sup> & Pyrites with Earth  
& Metals. Calcareous earths render Clay fusible.  
Clay is found with no acid but the Nit<sup>r</sup> with  
which it is often combined forms alum. With sand  
With inflammables separated by fire. With  
Iron. Fire & water can't separate the Iron.

Iron is more gen<sup>l</sup> diffused thro Nature than  
any other metals. The clay is separated from  
the Pyrites by water. All the Boles, Terra  
Lemnia & Sigillata, the basis of paints as  
Spanish brown, Rotten stone, Lapis Cali-  
naris, Stalactes are unctuous soft substances.

Soap Stone, & Lapis Serpentinus are clays.  
The last contains Iron & differs chiefly in this.  
Tripoly is wood changed into clay in the Earth.  
Garden Mould is a kind of clay.



Flints or Vitrescent Earths are remarkable for  
their hardness & striking fire with Steel. Fire  
acts feebly on them by themselves & only alters  
their colour. When pure they are of a milky  
colour. Acids have no effect on them. Alkalis  
& Nitrates render them fusible. All flints  
are fused by Salts. Glass is made generally  
of Sand & a fixed alkali called Stalk. Borax  
is used in making the best & clearest glass; Potash  
is made of it. Potash is generally used & is the  
best in forming glass, with Sand. Sturbridge  
clay when burnt makes the hardest & strongest  
vessels. Too little alkali makes the glass turbid  
& capable of being acted on by the acids; Too much  
makes it soft. Calx of Lead is used in making  
the white, clear glass of which Decanters &c  
are formed. The glass vessels should be always  
annealed or else they will be useless, as they are  
so brittle as to be broken by the scratch of a  
pin. Cobalt or Sapphire is used in making  
red & brown glass; the calx of Iron to make it  
yellow; the precipitate of Gold to make it  
purple; Manganese to make it violet; &  
Copper to make it green. <sup>small quantity of Cobalt is used in making</sup> Porcelain <sup>blue glass.</sup>  
was invented in Japan & from thence spread  
into China. It is made of a particular kind of



Clay called Kaolin, & of Flint called Pctunty.  
The latter is natural & a vitrifiable earth.  
Steatites in England & Granite in Scotland  
is used to make china. It mixed with sand  
in most countries which is separated by washing  
it & reducing it to a powder. The Enamel is  
made by powdering glass very finely, mixing it  
with water & dipping the ware into this  
mixture, which, by the great heat of the Furnace  
melts & thus forms the enamel. The diff<sup>t</sup>  
colours of it are owing to the calces of Metals  
Matters with which it is mixed; & the colour  
of the Porcelain itself is owing to Paints<sup>ch</sup>  
anxured & incorporated with it. The flinty  
promote the fusion of the calcareous earths.  
They are insoluble in water, but by simply  
calcining them & mixing them with one  
fourth part of Sal. ammon, they are diss-  
solved in Water. Equal parts of Borax & white  
sand make the hardest & most colourless glass. Glass  
is tinged green, by adding 50 of its weight of copper either  
calcined or in its metallic state; blue by Laffre, pos-  
sible by Manganise; red, by Gold, yellow by silver, &  
calcined Iron. Pulverised charcoal, wheat flowers,  
resin, & several other inflammable matters tinge  
Glass yellow like Topaz.



Lect: 20<sup>th</sup> Dissolution of Sal. Epom. Zij in  
water, by the addition of an alkali precipitates  
Magnesia alb. 3j. (Alkali or Hyposulphate)  
are neither affected by Heat nor Moisture,  
therefore we can't examine them chemically,  
but must be content with y<sup>e</sup> Natural History.  
I shall now give the Natural History of the  
Flinty or vitreous Earths, which are insoluble  
in the acids & water, & are vitrifiable by  
Heat. Common Sand is composed of small  
particles. Gravel is of this kind. They are  
not acted on by fire without the addition of  
an Alkali. True stone is composed of small  
particles of sand; it's used in Building, & is  
vitrified without the addition of an alkali.  
Lava, Pumice-Stone, Portland-Stone, Whet-  
-Stone, ~~etc~~ are species of Flint. Flint  
don't strike fire with steel, is easily scraped  
& owes it's colour to inflammable matters. It's a  
compound of the Vit<sup>e</sup> acid & a calcareous earth.  
The Touch Stone is of this nature. The  
Gun-Flint is very hard, vitrifies by heat,  
grows heavier by the action of fire, is decom-  
posed by the air, & the surface exposed to the  
air is converted into a white substance of  
the nature of chalk, which proves it's de-  
composition & that Flint is changed into chalk.



Chalk can be also changed into flint, therefore  
both opinions are true. ~~Of~~ Onyx, Opal,  
Garnet, Cornelian stone, Agate, Mosaic  
stone a kind of Agate. I believe with M.  
Buffon, D.<sup>r</sup> Hunter & Macaulay that the  
marks observed on Children, that had their  
origin in the Uterus are mere Lusus Naturae  
& by no means, depending on the imagination  
of the Mother as numerous facts have proved.  
If we believe the contrary, we must allow to  
Mothers a creative power, which is impious.  
Jasper, Porphyry, Lapis Lazuli, Quartz,  
Fusible Spar & Pectunty come under this class.  
Jasper is not so hard as flint & vitreous  
without any addition. Quartz is looked on  
as a sign of Metals, it fuses. Fusible Spar  
don't effervesce with acids. Pectunty is a Har-  
dy earth. Crystals strike fire with intense  
steel & fuse with intense heat. Ruby,  
Sapphire, Topaz both true & false. Im-  
ethyst, Emerald & Beryl belong to the  
many sided crystals. Emerald is the most  
rare & valuable precious stone. Lapis  
Lazuli contains Iron. The colours of the  
diff. crystals are owing to the Metallic  
substances they are mixed with. The false  
precious stones are distinguished from the  
true by their colours being destroyed by fire.



Ag. fort. changes their colours. The hardest  
Crystals in Nature contain water. They  
are the purest elementary Earth. Effervescent  
Earths. Mica is composed of small & disuniting  
particles which have a sparkling & unctuous  
appearance, called also glimmers. Talk or talc  
i.e. Isinglass has a greasy feel, is transparent  
& is separated into very minute laminae.  
Korn Stone is greasy to the touch. Amie-  
anthus & Asbestos are very much alike in  
every respect. They are made up of fibres  
lying parallel to each other. It is often woven  
with lint into a fine cloth; it has been  
formed into Aprons, handkerchiefs, & purses.  
A German Author made a book of it, &  
wrote in it on the nature of Asbestos. Fire  
purifies it & deprives it of all its colouring  
matter. It is found in all parts of the World.  
The inhabitants of Siberia make light of  
Talc instead of glass. Asbestos is found in  
Pennsylvania & the best of it in Corsica.  
It is called Cotton Stone. It is woven with  
cotton into cloth. Calcareous Earth, Clay &  
sand or Silix or flint are frequently combined  
together. No one of the Earths is ever found  
perfectly simple but always mixed. The  
purest of crystals contain clay, water &  
calcareous earth.



Mum is used in Medicine as an  
astringent. Mum. Uel. is the safest emetic.  
Mum. coag. is good for sore eyes. The best use  
the composition of Eye waters. Boles are inert  
& useless. Inflammables are those bodies which  
enrich flame & burn on the accession of fire or  
heat. Charcoal is an exception as it does not flame.  
The principle of inflammability is divided into  
light & heat, & can't be separated from bodies  
without light or heat or both; it can't be separated  
entirely in its separation consists in inflammation.  
Flame is vapour in the state of inflammation.  
The vibration of flame is owing to the agitation  
of the air. The reason that it is surface only of the  
fire burns, is that the air comes in contact only  
with the surface. The broader the surface of the  
burning body, the more soot & vice versa. Soot  
is composed of Oil & gas & part of the wood driven  
up. The longer the pipe the more complete &  
slow the consumption of the wood & the more  
heat.

Basalt,  
& Lava are one, & the same species of substance,  
they as well as most volcanic substances are fusible  
per se.



Let <sup>it</sup> 21. Inflammables are divided  
into 1. Phosphorus, 2. Sulphur, 3. Charcoal,  
4. Ardent Spirits, 5. Oils & Bitumens.

Phosphorus is composed of the Phosphoric acid  
& a great quantity of Phlogiston in a loose  
state. It emits light without the contact  
of any other heat than the Atmosphere  
naturally contains. It is divided into Natural  
& Artificial. It is a compound body, of  
Phlogiston & a fixed matter. The Phosphorus  
of Urine is most generally used for experiments.  
The common heat of the Atmosphere decom-  
poses it & detaches its Phlogiston. All the  
Mineral acids decompose it. The Vit. acid  
decomp. it without flame; the Nit. acid  
with great violence; the Muratic acid has  
a very slender attraction for it. It unites with  
no Metals but Copper & Zinc which it cor-  
rups very inflammable. It unites with the  
calces of Metals, & most readily with Sul-  
phur. Copper united with Phosphorus, be-  
comes very compact & heavy. It dissolves in  
Oils readily; but not in water. It is made from  
Charcoal & Urine. Hum. & of any Vegetable  
matter produce it. Kunkel made his Phos-  
phorus of Vit. acid & calcareous earth. Meteoric  
Shooting Stars &c. are owing to a separation  
of Phlogiston. The lustre of the Diamond  
is owing to the gradual separation of the prin-



principle of inflammability. Its lustre is diminished by long exposure to the air, but may be renewed by exposing it to the sun's light, which it absorbs & fixes, & parts with a part towards. White bodies absorb the light & emit it in the dark. Rotten wood, Rotten flesh & fish owe their light to the reparation of their Corruption which is more easily effected by the resolution of their parts by putrefaction. Fire flies owe their light to the escape of the same principle which is constantly supplied & lost. The luminous appearance of the sea about Malabar & the Maldivia Islands is owing to an oil emitted from the bodies of animals of the Phosphoric kind.

Sulphur sublimates in a moderate heat, but is not decomposed except in a great heat. It combines with the fixed alkalis making Hepar. Sulph. but not with the vol. unless in a compound state; with the calcareous earth only; with the inflammables as Oil, Sp. Vin. which it unites with only in fumes. It unites with all the Metals but Gold, Zinc & Platina. It does not mix with water.



It is found every where almost. Italy is  
a bed of Sulphur. It's native & artificial.  
The native is divided into Pure & impure.

The pure is found in Guadalupe in a fibrous  
crystalline, & solid form, & floating on the  
top of Springs. The impure is mixed  
with calcareous earth, clay, Ores & Metals.

Pyrites & Mundick are synonymous terms.

Pyrites is composed of Sulphur, Arsenic,  
Copper, Iron & clay which latter by its  
decomposition in the air forms alum. <sup>sitting & being</sup>

White where Arsenic abounds, green where  
copper & blue where Iron does. On exposure  
to the air, the Phlogiston escapes & it decom-  
posed. It's sublimed from this by heat.

Mercury & Antimony contain the greatest  
quantity of it from which as well as from  
the other metals it's obtained by sublimation  
fusion & calcination. It's obtained in Italy  
from Salpatera by sublimation. Charcoal  
contains Phlogiston in large quantities, fixed  
air & earth. It's unalterable by the most  
intense heat, if it's confined in a vessel. The  
loss of weight it suffers by combustion, is occa-  
sioned by the extrication of its fixed air;  
which it's proved to contain by its explosion  
with Nitric which Sulph. don't & by its noxious  
effects. It's insoluble in water or air. Burning  
the ends of rods stuck in the Earth closes its pores &  
prevents its rotting.



No acid, alkali, caustic, earthy or inflammable matters act on it without heat.

Marcasites a synonym of Pyrites. The more  
Poor Pyrites contain the <sup>more</sup> sulphur the  
more copper. The less sulphur the more  
arsenic the less sulphur. Marcasites ap-  
proaches nearest to a pure Ore.

A Gentleman predisposed to the Gout  
had one side reduced to a completely Para-  
lytic state by only drinking two glasses of  
a poor sour Wine; the affection seized him  
very soon after drinking it.



Lect. 22. <sup>rd</sup> Adont Spirit is a highly  
rectified inflammable Sp<sup>l</sup> Vin. It is  
tained from the juices of all sweet vegetables  
during the Vicious fermentation, as well  
as Wine. It is composed of Oil, acid & water.  
It inflammation depends on its oil. It  
contains less of the principle of inflamma-  
bility than any of the other inflammables.  
It is proved to be perfectly dephlegmated  
from leaving cotton dry & powder also after  
its combustion, but this is not certain as  
the water it contains may by the least  
be converted into vapour; & the most  
pure always contains some. Other is  
produced from its mixture with the  
diff<sup>l</sup> Mineral acids; & late experiments  
have made an acutous Other. Vit<sup>l</sup> acid  
& Alcohol distilled together yield Vit<sup>l</sup>  
Other which is a colourless, very volatile  
& very inflammable fluid of a fragrant  
& penetrating odour. It boils in the heat of the  
human <sup>body</sup>. The pressure of the Atmosphere only  
prevents its entire conversion into vapour. It boils  
in Vacuo with a less heat than that of the Atmosphere.  
The fine Oil of the Alcohol forms the Other. A piece  
of Sugar dipped in Other & thrown into water by its sol<sup>n</sup>



tion with a little degree of heat & it goes the ether  
which by reason of its superior levity rises to the top.  
if a lighted candle be put in contact with the sur-  
face of the water, it sets it all in a blaze, but it is  
only the ether on the surface of the water that  
burns. In this manner all the essential oils  
burn. If water that has been long stagnant,  
such as old Ponds contaminated with putrid matter  
be stirred, & a lighted body touch the surface it  
will be all in a blaze owing to the inflammation  
of the Naphtha or fine fossil oil that rises to  
the top. Those which have bottoms of black  
earth exhibit the Phenomenon best. It is too  
volatile to be mixed with any of the objects  
of chemistry. It is difficultly miscible with  
water requiring ten times its weight of water  
to dissolve it. The proportion used to be one part  
of Nit. acid to four of S. P. Vin. but as present  
it is equal quantities viz. one part of Nit. acid  
to two parts of S. P. Vin. In the distillation  
the first is a Spirit that comes over, & next a  
fine subtle oil which is the ether. The mixture  
of S. P. Vin. & the Nit. acid raises an ebullition,  
altered their qualities & a fine flavour exhales.

Nitrous ether is made from a mixture of 2 parts of  
Nit. acid. & 3 of S. P. Vin. M<sup>r</sup>. Woulfe has con-  
trived an apparatus to confine the steam.



Fixed Alkalies dissolve partially in Sp. Vin. the  
proportion in order to dephlegmate it which is  
best done by fixed alkali is 8 of fixed alkali  
to 10 of Sp. Vin. The more caustic the Alkali  
the more perfect its solution. From the mixture  
of equal quantities of Sp. Vin. & Vol. Alkali  
in solution a fixed solid mass is formed called  
Ossa Helmontii. On shaking the mixture  
an opaque dense coagulum is formed, which by  
warmth soon resolves into a solid & a fluid part.  
It is occasioned by the Sp. Vin. absorbing the water  
& suffering the Vol. Alk. to congregate together.  
It has a very strong attraction for water. Acts  
on none of the earths but Quick lime & that only  
in the state of Sal. Ammon. fix. Acid Spirits  
dissolve Phosphorus; precipitate Neutral salts  
from their solution in water, by attracting the wa-  
ter; act subtly on Metals, except Gold which it  
attracts strongly; & restores lustre to Gold &  
Silver lace by supplying them with Phlogis-  
ton to whose presence their lustre is owing. It  
strongly antiseptic; & is procured from all  
kinds of Spirits. It is the lightest of all  
fluid liquors.



Lect<sup>r</sup> 23. Oils are divided into Vegetable  
& Animal; & the former into Aromatic  
or essential & Unctuous. They contain  
a large quantity of Phlogiston, water  
which is the basis of them, & earth which  
on the distillation of the Oils appears  
in a carbonaceous form; & a saline  
matter which is either vegetable acid or  
Vol. alkali. The Heat & light separated  
during the combustion of the Oils prove  
that they contain Phlogiston. The  
Phlogiston is closely combined with  
the Oil for which reason they are not  
so inflammable as would be expected.  
The smoke of the Oils in combustion is  
converted into Soot which is A Vol.  
alkali, water & a fixed matter. Un-  
ctuous Oils yield more soot than the  
Aromatic. By being confined & burning  
with a small flame, the accumula-  
tion of soot is prevented. Aromatic Oils



have a pungent taste, fragrant odour,  
very volatile & evaporate completely by  
dissolve in S<sup>p</sup>. Ven & have not that oily  
feel that the Unctuous Oils have. Some  
of them are lighter & others heavier than  
Water. They require an intense degree  
of cold to freeze them. Their fragrance  
depends on their water. They take fire  
much easier than the Unctuous Oils, by  
mixture with the Vit<sup>a</sup>. acid they flame  
& are converted into Pitch. Nitrous acid  
unites with them with great violence &  
impetuosity, more than Vit<sup>a</sup>. acid. Muriatic  
acid darkens their colour but with Phlog.  
Vit<sup>a</sup> acids have no action on them. They  
have small attraction for alkalis, & form  
with them soap. The more caustic the  
Alkali the more intimate the Union.  
They have a strong attraction for the Caustic  
the Vol<sup>a</sup>. Alkali. They have no action on the  
Neutral Salts nor on the Earths. They  
dissolve Sulph<sup>r</sup> & Phosphorus. They  
act on the scales of Lead, Copper & Iron;  
Lignite with water. In distillation,  
their odorous principle first rises, then a  
Oleum, then the Oil, growing impure



towards the last. They are found chiefly  
in Vegetables; & also in some animals as the  
Musk & castor which are the chief in animals.  
They are secreted in the Plants which  
have two kinds of vessels. 1<sup>st</sup> those which  
receive nutriment & convey it to diff<sup>t</sup>  
parts & 2<sup>nd</sup> those which secrete the diff<sup>t</sup>  
juices as the Glandular Cells, on which  
depends the fragrance of vegetables &  
their odour; called Spirit. Rectified by Boerhaave  
&c. Some appear Solid & others fluid.  
The Plants should be put in the still  
till the water boils, which buoys them &  
prevents their coming in contact with the  
hot still which would injure them. The  
first thing that rises is a phlegm, then  
an acid & lastly the oil. The still &  
Refrigeratory are used. The best kind of  
Receiver is one in the form of a Coffin  
Pot. The simple waters are preferable  
to the Oils which are too pungent; they  
are impregnated with the fine parti-  
cles of the oil. Camphor & Benzoin  
are treated on sufficiently by Neuman,  
Macquer & Fourcroy.



Unctuous Oils are bland & inodorous, have  
an oily feel & all float on the surface of  
water. The crackling noise heard on throwing  
Oil in the fire is owing to the escape of  
watery particles it contains. They unite  
with the Mineral acids without heat  
or flame but are converted into a pitchy  
substance. They unite with Alkalis  
forming Soap. Animal or Vegetable  
Oils make soap with either the Min or  
Veg<sup>l</sup> Alkali. They unite with no earth  
but Quick lime. Castile Soap is made  
of the Oil of Olives & the salt of the Kali  
or Lye a mineral alkali; one third of  
Quick lime is added to make the Alkali  
more caustic; the soap thus made is soft,  
but is hardened by adding 4 or 5 bushels  
of Common Salt to C 12 of it; this sudden  
hardening of it is occasioned by the salt  
attracting the water & falling to the  
bottom while the above borders sit out  
by wire into the suet brought to us; it  
accounted for on the same principles that  
the making of the Offa Helmontii by  
mixing Sp. Vin & Sp. Sal. Ammon  
together, is. The colour of the Venice soap  
is owing to the Vegetables used to colour it green



The Oil men in England deprive the Oil  
they get from the coast of the Mediterranean  
of its rancidity by throwing in some Sal. com.  
which attracts & dissolves the water & mucilage  
it contains to which is owing its rancidity;  
I preserve it from rancidity by now & then  
throwing in fresh ~~the~~ Salt. The inferiority  
your Soap to the Castile is owing to our  
using Animal Oil, but this might be re-  
medied by substituting for it the oil of  
the Sun flower seed which yields it in great  
abundance & equal in quality to the Oil  
of Olives. The powerful action of Soap on  
vegetables in bleaching, & on animal bodies  
is owing to the caustic alkali in it which is  
not saturated with the Oil. They dissolve  
the calx of Lead, & prevent Iron rusting  
hence used to prevent Iron instruments from  
rusting. Animal & Vegetable substances  
are prevented from putrefying by being  
covered with Oil; thus eggs are preserved  
much better than in Salt, which unless it  
entirely covers them, hastens their putrefaction.  
Air acts remarkably on them, in turning  
them rancid.



Washing them in water slightly, by intro-  
ducing more moisture which favours their  
fermentation, promotes their rancidity; but  
washing them frequently in a large quantity  
of hot water, by dissolving this mixture  
& carrying it out purifies them & prevents  
their rancidity: the best way to preserve  
butter is to press out all the moisture  
perfectly without washing it. They are got  
from Sun flower, flax seed &c. & from animals  
as Spermace, Sassa. Wax &c. ~~Bitumens~~  
are inflammable, <sup>solid, soft, or fluid</sup> Mineral bodies; <sup>strongly aromatic, smelly</sup> & are di-  
vided into fluid & solid. Naptha is the  
finest of them & is little else but the pure  
principle of inflammability. It can be set  
on fire without the contact of flame;  
here in Mexico ascending in Naptha, a tree  
is made use of to give light by rolling on a  
barrel of Flint Stones. It is impossible  
to set Gun Powder on fire without flame  
but may be with coal, fluid &c. Petroleum  
is an inflammable liquid Bitumen, found  
in the Earth in Persia & other parts of the Globe  
<sup>running between Rocks,</sup>  
& on the surface of Springs. In Barbadoes it  
called Mountain or Barbadoes Tar. Coals  
are solid Bitumens & differ only in degree of  
inflammability.



It is the furthest Coal. Kilkenny very bad.  
Lannel coal is very good. A coat of Pitch &  
Tar is an excellent preservative to keep wood  
from rotting. Amber is an electree, a solid  
Bitumen, but was once fluid as appears  
from the insects found in the midst of solid  
pieces. It yields an acid by distillation <sup>which is</sup>  
<sup>from amber small, of a salt, of a crystalline, of a pitted colour.</sup>  
<sup>The resin is black, brittle most like bitumen of Judah & a little Iron.</sup>  
Sulphur, La Jene fragrant useful Oil.  
Nit. acid & St. Suen. mixed together give a  
smell very much like Musk & after 24  
hours the mixture produced might be used  
with advantage instead of Musk. It is found  
mostly in small pieces on the coasts of the  
Mediterranean & never in pieces exceeding  
85 or 86. Petroleum comes from the bottom  
of the Sea. Sulphur never enters the cir-  
culation, as it is insoluble in any of our fluids  
but Lapis unchanged through the dimen-  
sary canal. It is a good medicine in Eruptions  
in which it acts as a gentle constant purgative  
by taking off the determination to the  
Skin. Sulphur & Oil form Bals. Sulph.  
The Anthon Oil is made soluble in water by  
the intervention of the yolk of an egg. They are  
obtained in the largest quantity by expression &  
boiling. Amber is a yellow transparent substance  
which neither be acid nor alkalis.



Bitumens are found forming layers in the heart of the Earth, dropping through Rocks, or swimming upon the surface of waters. They have an analogy with organized bodies. They give an odorous phlegm, coloured & saline, an acid frequently concrete sometimes Vol. Alkali & Oils, which from being light gradually become thicker & more coloured & a chancy matter. Origin vegetable or animal. They suffer an alteration from light. Their colour deepens & their smell is modified in transparent vessels. In proportion as they thicken & dry them, their Spiritus rectior dissipates. Water stup.

Art. 24. Metals are shining, opaque, uninflamable bodies, insoluble in water, are fused by fire, are the best conductors of Electricity, & have the greatest specific gravity of any bodies in Nature. They melt in different degrees of Heat according to their volatility. They are composed of Phlogiston & a fixed matter. A metal is calcined after the privation of its Phlogiston. The more perfect the loss of this, & the more they recede on the appearance of an Earth & vice versa. Some metals are vitrified by heat. Some part with their Phlogiston easily, & others difficultly. Some in melting emit both Light & Heat, & others only heat. They can't be calcined without air. They are increased in weight, by calcination. When acids act on the Metals, from which a salt is formed called a Metallus Salt, capable of



crystallization & of solution in water.

Some of these Salts are very caustic, hence called Potent Calcaeries, & others are not.

The effervescence occasioned by their solution in the acids is owing to the separation of  $\Delta$ .

It is necessary. After the solution or calcination of the Metals by the acids, the acid & the Metal conjointly, & the latter singly is

heavier than before the solution. Lead gives

acid the least acrimony of any of the metals.

They are separated from the acids by Alkali. Al. Ven. Oils & Metals. The alkaline

Salts act feebly on the Metals. Borax is

used in Soldering, & as a flux to promote

fusion; it serves as a medium between

the Crucible & metal, & transmits the heat.

Neutral Salts act on the Metals in propor-

tion to the strength of their acid. They don't

unite with Earths & calces; they unite with

Glass giving them those pretty colours observed

in false gems. They have a slender attraction

for the principle of inflammability. The

change of a calx to its metallic state is

called reduction, & is effected by restoring



to the calx a proper quantity of Phlogiston  
by means of Charcoal, Unctuous Oils, Sulphur  
&c. by this process, they lose the increment  
of weight they had acquired by absorbing  
dephlogisticated air, & are restored to their  
primitive state. Combined with the acids  
they dissolve in water, & some do without  
but it by the intervention of the aerial  
acid. The rusting of a Metal is owing to  
escape of its Phlogiston. They are found  
in the bowels of the Earth, mostly combined  
with Earths. The following are arguments  
proving dephlogisticated & fixed air being  
absorbed by metals in the act of calcination.  
viz. 1<sup>st</sup> Metals become heavier by calcination,  
either in the acids or by fire; whereas a mild ac-  
id mixed with an acid loses one fourth of its  
weight by the fixed air escaping in effervescence.  
2<sup>nd</sup> Metals cannot be calcined in a confined place  
but require supplies of fresh air, whereas alkalis  
can be dissolved in acid with fresh air in a confined  
place. 3. Caustic alkali does not become mild  
by being placed near a calx during its reduction.  
4. In the rusting or calcination of Iron fixed air can  
be separated because calcareous earths do absorb & don't  
fixed air on exposure to the atmosphere. 5. The dephlo-  
gisticated air separated from a Metal in its reduction  
is just equal in weight to what the Metal acquired by calcination.



Sept 25<sup>th</sup> Dephlogestiated air is absorbed  
consolidated by a Metal in its calcination.  
Arsenic is a heavy, compact, brittle body  
of a glassy appearance. It found sometimes  
larger, & sometimes in smaller pieces. They  
lose their colour by exposure to air. Pure air  
gives a red colour to bodies, thus Colcothar of  
Iron, or calx of Iron, & Minium or calx of  
Lead lose their red colour to the action of  
the Dephlogestiated air; & Flams cured  
with Sal. Nit. lose their red colour to it  
Dephlogest. air detached from the Nitre in  
its decomposition or in the union of the Nitrous  
acid with the Phlogiston of the Meat. Arsenic  
is fused by gentle heat, & in its fusion emits  
vapours smelling like Garlic. It dissolves  
in all the Mineral acids, & in the fixed  
Alkalis with effervescence. It effervesces with  
Nitre producing fumes. It produces no change  
on Common Salt; & bears no relation to  
Earthy Substances. It unites with Sulphur  
forming Aspidium.



Combined with Lead, it makes a very good  
flux. It has a strong attraction for  $\text{S}$  or Phlogiston.  
It is composed of an acid, & Phlogiston. The pro-  
portion is, 20 parts of acid, & 80 of Phlogiston.  
With Alkalis, it forms a salt that does not de-  
compose in the air. It has a strong attraction  
to Copper giving it a white colour & making  
it very brittle, & hard. In this manner, the  
white Metals are made. It is generally com-  
bined with Earthy matters, & obtained  
pure by sublimation. There are three ways  
of detecting Arsenic in Bodies; viz. 1. By  
throwing it upon coals, by which it emits a fume  
smelling like Garlic. 2.<sup>nd</sup> By placing it be-  
tween two plates of Copper, binding them  
together tight, & putting them in the fire.  
if the matter contains Garlic, the copper will  
be tinged of a white colour. 3.<sup>rd</sup> Another  
fallible is to mix the suspected matter with  
a solution of Blue Vitriol, it is done in this  
manner; viz. Dissolve the matter in a strong  
solution of ~~the~~ fixed vegetable alkali, & mix  
this solution with a solution of Blue Vitriol.  
If the matter contains Arsenic, it will precipi-  
tate the Vitriol of a green colour.



D<sup>r</sup> Way communicated to me the following  
wash which he found to answer better than  
any thing else in the cure of Cutaneous E-  
ruptions. Pour this of boiling water on ʒi of  
Arsenic, let it boil untill it is wasted  
away, then let it cool, & wash the erup-  
tions with it. Great care must be taken  
during its boiling lest the vapour come in  
contact with the skin, as it is very hurtful.  
It dissolves in 15 times its weight of cold  
water, & eight of boiling. A Gentleman  
in the West Indies, who took ʒi of Arsenic  
instead of salt was cured by swallowing of  
a large draught of warm water, which  
by vomiting him for several hours, Dissol-  
ving the Arsenic cured him.

Metals are separated from the foreign matters  
with which they are united, by Exposing,  
Roasting, & Mixture. Exposing is the se-  
paration of Metals from their Ores & from some  
metals by fire. Roasting is the separating of



Arsenic & Sulphur from Metals by heat, they  
being very Volatile. After these Mixture is  
made use of but it's usually combined with heat.

All the acids act on the Ores of Metals.

Metals are cleaned of the Earthy matters with  
which they are mixed naturally, by washing  
the ores in warm water which unites with  
those matters. The separation of the Metals  
from each other is effected by eliquation, &  
depends on the difference of fusibility.

The Black Flux is a compound of Tartar  
& Charcoal, & used only in small furnaces  
as it's too expensive; but is the best flux.

White Flux is made of equal parts of  
Nitre & Tartar. Quick lime, Alkali & Neutral  
are generally used.

Imperfect Metals are destroyed by air  
& fire. Perfect suffer no change on expo-  
sure to air & fire, & possess both Mallea-  
bility & Ductility. Semimetals have neither  
malleability nor ductility. Simple  
possess both Malleability & Ductility.

The acids and with Ores, discover Copper  
by being tinged of a green colour; & the Vige-  
table acids discover lead by acquiring a  
sweet taste.



Gold is discovered by aqua Regia, which  
being dissolved in it is precipitated after-  
wards by alkalis, or Mercurium fulminans.  
Sulphur & Arsenic or Orpiment is  
a good flux. Alkalis are used in Ex-  
siccation to promote the fusion of the  
Earths &c. with which Metals are u-  
nited. Sandiver is a good flux. A mix-  
ture of Potash Alkali, tal. commun.  
A little glass is a better flux than  
the alkalis. Charcoal is a flux as it pre-  
vents the calcination of the Metals by  
great heat, & for this purpose they should  
be confined from the air. Quick lime  
is the only earth used as a flux & is  
liable to the disadvantage of the alkalis  
by uniting with Sulphur if present, &  
forming an Aesop which is an effec-  
tual solvent of the Metals. Fusion is  
promoted by deflagrating two salts. The  
most refractory Metals are melted by direc-  
ting the flame to them by a blow-pipe.  
Water is used as a flux. Sulphur & Iron  
united together are separated & the Iron obtained  
pure by adding Iron which has an attraction  
for Sulphur; Alkalis would not do, because by uniting  
with Sulphur, it would dissolve the Iron.



Lect<sup>r</sup> 26<sup>th</sup> Mercury is the heaviest of  
all bodies, but Gold & Platina. Its spe-  
cific gravity <sup>to water</sup> is as 14 to 1. Pure Mercury  
cannot be congelated; but impure may  
as Professor Braun did at Petersburg.  
It is very volatile, & may be entirely eva-  
porated in a degree of heat not much  
greater than that of boiling water.  
It is triturated with Crabeyes, Symp<sup>l</sup>, Balsam  
Resins & Gums which only act mechanically  
in dividing the particles, for its more convenient  
& effectual exhibition. <sup>It is thus rendered active</sup> By trituration, part of  
it is also calcined. It is calcined in a degree of heat  
less than that required for its evaporation. This  
is a pure calx of a red colour which is owing to  
absorption of dephlogisticated air, & is im-  
properly called R. R. per se. Nit. acid dissolves  
it, which, by the addition of Hot water falls to  
the bottom in a yellow powder called Turpe-  
them Minerale. This is repeatedly washed & pur-  
ified for use. Nit. acid acts on it more powerfully.  
Ag. for. dissolves an equal weight of Quick Silver,  
& acquires a red colour from the Phlogiston in it.  
Iron is the only metal, that Mercury won't unite with.



Ward's Drops are made by mixing Nit.  
acid. Zivj with M. Sal. ammon Zivj. After  
the effervescence has ceased, adding Argent. viv.  
Ziv. which must digest in a gentle heat till  
the  $\Delta$  is dissolved, & then adding Ag. Rosar.  $\frac{1}{2}$ ij.  
Two of these drops contain  $\frac{1}{2}$  gr. ss & are given  
twice a Day. Mariatic acid is capable of  
dissolving the Mercury only in its cal-  
cined state. Mer. corros. sub. is made by  
mixing Ag. fort. comp. &  $\Delta$  in equal quantities,  
& then subjecting them to heat, by which  
all the moisture is evaporated & a red dry  
mass is left, that is precipitated without  
a third body, & calcined by Heat & Mixture.  
Alkaline Salts separate  $\Delta$  from  $\Delta$  Nit. acid.  
M. Vir. & Aromatic Oils also precipitate  
it by restoring  $\Delta$  to  $\Delta$ . Mariatic acid  
dissolves the calx of  $\Delta$  more readily than  
either of the other acids, but don't touch it in  
its metallic state, they can't be separated from  
each other by heat but rise together in the  
Retort. Mer. Corros. Sublim. is formed.  $\Delta$  de-  
composed of its Mixture by being dissolved in  $\Delta$   
or Nit. acid is separated & the residue from either of  
the acids.



Merc. dulc. is a compound of Argent. viv. & Corros. Sub. it resembles Corros. Sub. in colour but don't impart such an acrid taste to the tongue, owing to the acid being blunted by the abundance of Mercury. Calomel is made by subliming  $\frac{1}{2}$  7 times.

Earths in their simple state have no action on it. Lime water unites with Corros. Sub. & forms Ag. Plagiden. It has a strong attraction for  $\Delta$ , but unites with none of the inflammables but Sulph<sup>r</sup>. with which it unites both by triture & heat. A theop's Mineral is formed by the triture of  $\frac{1}{2}$  & Sulph<sup>r</sup>. & Cinnab. Facted. by subliming  $\frac{1}{2}$  & Sulph<sup>r</sup>. It unites with all the Metals but Cobalt, Nickel & Iron; & forms an amalgam. It makes Gold very brittle, & soft. A Gold ring may be taken off from a finger that is grown too big for it, by rubbing it with Ung.  $\frac{1}{2}$ . Gold Watches & Buttons should be laid aside during the use of Ung.  $\frac{1}{2}$ . It also softens Lead, hence is used to extract leaden Bullets, by pouring the  $\frac{1}{2}$  on them in the Mound. Mirrors are made by placing a layer of tin foil on Glass laid exactly horizon- tally, & pouring Argent. viv. on it. It forms an amalgam with  $\frac{1}{2}$  tin & thus coats the Glass.



The Mercury can be separated from any  
of those Amalgamata by distillation.  
It can be dissolved in water in its pure &  
simple state. It is calined by triture.  
It is found in Spain, Italy, Hungary &  
East Indies. It is used to extract Gold from  
its Ore. It is sometimes found middling  
here, & only requires straining thro' leather;  
but for the most part, is combined with  
diff. Minerals, from which it is separated by  
distilling it with Iron filings, Lime &c.  
Mercury that has the least  $\Delta$  is the best to  
use in Medicine as it can be dissolved by  
the acid in the stomach, which being a  
Vegetable acid, & like Vinegar only act  
on it in its calined state. It is seldom found  
combined with Metals, never with any  
but Lead & Copper. It is known in Lead by  
the Vegetable acids which acquire a sweet  
taste.

It increases the circulation & all the excreti-  
ons but particularly the Saliva. It is most  
used internally. The more lean, & is the better  
it is for preparations by triture.



Lean Mercury is purified by Iron filings  
which restore it  $\Delta$ . Mercurial Plaisters  
are good in Scurvy; they act by confining  
the perspiration & relaxing the parts. A  
lady was lightly salivated by a Mercurial  
Plaister applied to a scirrhus in her breast,  
without having used a particle of  $\Phi$ . internally.  
In the  $\Phi$ . Ointments, the  $\Phi$ . enters the pores.  
The best way of making these Ointments is  
to divide  $\Phi$  with the grease with  
any of the Balsams, as they irritate & in-  
flame the tender skin to which they are  
applied. Particular care should be had to  
get pure lard with the least acridity; &  
little of it should be made at a time for fear  
of its growing rancid. Its purity is tried  
by rubbing a little of the Ointment on the  
ball of the eye, & if it excites not the least  
feeling, it is pure. Plenk's Solution is no so-  
lution, as it is only divided by the  $\Phi$ . Oral.  
& can be separated by fire or the interpore-  
sition of a 3<sup>d</sup> body. Peiser's Pills are made  
by saturating  $\Phi$ . with Vinegar till it re-  
solved to a calx in which state alone, the  
Vinegar dissolves it. — A scruple of the  
Mercurial has raised a salivation. J. Keen



Let  $P$  be In the Mere. Sacchar. & M.  
kalizatus. The  $P$  is only divided, in the former  
by Sacchar. & in the latter by calcareous earth.  
by adding Vinegar to the latter,  $P$  is got in  
a Metallic state. The best mode in general  
of exhibiting  $P$  internally, is in Pills made  
of Sugar & oil. Trichurated & exterguished with  
Honey. Turpeth Mineral is used with  
advantage in the Ulcerous Sore Throat  
whose cure should always begin with an Emetic.  
Turpeth Mineral is the most preferable vomit.  
Otheops Mineral is good for little, its effects  
are owing to the Sulph. which acts only  
by purging or relieving the disorders in which  
it is used.

**Antimony** is a semimetal. Regulus of  
Antimony is bright, composed of Needle like  
laminae which lie in regular order. Its specific  
gravity is as 7 to 1. It fuses in a red heat & vapor-  
ates in a little greater degree of heat. It is not mal-  
leable. Glass of Antimony is the Regulus deprived  
of its Sulph. by heat & air; it is acted on by the  
Vit. acid. It attracts the Vit. acid stronger than  
the Mercurius in its calcined state.



Nit. acid acts on it & is turned blue. Reg.  
Regia is the only proper solvent of the Regulus  
of Antimony. Butter of Antimony is very  
caustic; a drastic purge, & Corrosive. It decom-  
posed by Water, & the Nit. acid; it is made  
by subliming P. corros. sal. & Regulus of Antimony  
together, the Muriatic acid forsakes the P. &  
attracts the Antimony. Bergman has improved  
on the Tart. Emet. by making it of the pre-  
cipitate of the Butter of Antimony, &  
the acid of tartar; which he calls Antimoniated  
Tartar. All the Vegetable acids act on it in  
its metallic state, <sup>whether</sup> more or less calcined. Tart  
Emet. should not be made in vessels of Iron & Copper,  
because they attract the Vegetable acid more  
strongly than the Antimony. Alkalies have  
no action on Antimony, when deprived of S.  
which it is always combined with in the bowels  
of the Earth. It is dissolved by Niter Sulphuric.  
Regulus of Antimony can be combined with  
almost all the Metallic substances. It is in-  
soluble in water. Vegetable acids & Antimony make  
Tart. Emet. Heat dissipates the Sulph. & calcines  
the Antimony, the more it is deprived of its  
Sulph. the more active, & the more it is acted on by Veg. acids  
Copper & silver come in for their share  
of them.



It separated from its Ores by Heat & Mixture.  
Sulph<sup>r</sup>. Nusat. Antim. is made by uniting  
Antimony with a mixture of Sulphur &  
Alkaline Salt by fusion, dissolving this  
mixture when cool & powdered in three times  
its quantity of water, filtering it & precipi-  
tating it with Sp. V. S. T. Kermes Mineral  
is synonymous. Antim. Diaphoretic. is made  
by deflagrating 3 parts of Nitre, & 1 of An-  
timony together, if washed it's called Lotum.  
Crocus Antimon. or Metallorum is made by  
fusing equal parts of crude Antimony &  
Nitre together. Lime water only acts on  
Antimony by the addition of N. Acid.  
It don't attract inflammables. Iron from  
its greater attraction to Sulph<sup>r</sup>. is used to  
separate Sulph<sup>r</sup>. from Antimony. The Wax  
does no good in the antimony as it's insoluble  
in any of our fluids. Vin. Antim. is an un-  
certain medicine since its strength depends  
on the acidity of the Wine, & greater or less  
calcination of the Antimony. Tart. Emod.  
is the best & should be the only preparation  
of Antimony. Cinnab. Antim. is the same as Cinnab.  
fact. & made by subliming the residuum remaining

in the Mercat area.



after making Butters of Antimony & which is the  
P. of the sub. corros. & the sulph<sup>r</sup> of the Antim.  
Nitric or sal. Glauc, & Tart. Emet make a  
very good febrifuge powder. The former should  
be used in Winter when inflammatory fevers  
rage, & the sal. Glauc. in Summer when  
Bilious, remitting fevers prevail, which  
don't require Nitric at all. The Tart. emet. used  
should be so strong as to take with one grain.  
The proportions are, one sixth of a grain of this  
Tart. emet. to 10 grains of Nitric which must be  
repeated every two hours, & 15 grains of sal.  
Glauc. which must be repeated. These  
powders are very effectual by universally  
bringing out a sweat without increasing  
action of the Heart & Arteries. If the above  
quantity of Tart. Emet. don't vomit or nauseate,  
it must be increased till it does, since it  
can't possibly sweat without exciting a sen-  
sation at the stomach for the most  
part Nausea. Whatever sweat does come  
out without nauseating the stomach, it  
must be accidental.

Colic & Nettle come next, but I have not  
said them.



All the metals except Gold & Mercury have a greater affinity with Sulphur than the regulus of Antimony. Iron & Lead have no affinity. Gold & Sulphur have no affinity. The crystals of green & blue Vit are Rhomboidal.

Zinc has a greater affinity than Iron or Copper with the Vit. acid, & decomposes the Vit. carol. & virid.

4 parts of Zinc & one of copper make Brass. 1 part of Zinc, 10 of copper, & a little Zinc make Bell metal or Bronze.

Sept 28<sup>th</sup> Zinc is of a whitish blue colour; possesses very little ductility, which is greater according as it is deprived of its  $\Delta$ . Specific gravity as 7 to 1; melts in a degree of heat little lower than red heat; evaporates entirely in a great heat. Vit. alb. is formed from Vit. acid & Zinc; it is a crystallized Salt. Nit. acid acts on it violently, producing red fumes.

Alkaline Salts have no action on Zinc.

Nitre deflagrates with it violently. With clay, it forms Lap. Calamin. It is hardly possible to detach all its  $\Delta$  from it, it has



adheres so firmly. It don't attract sulphur.  
It can be mixed with all the Metals but  
<sup>Cobalt</sup> Bismuth & Nickel. Mixed with Tin, it  
forms Pewter; with Lead, the metal for types;  
with Copper, Brass; with charcoal & little  
copper, form black-lead. It's most frequently found

combined with clay. BISMUTH, is a hard  
sonorous substance. Purifies with all the metals  
except Cobalt & Zinc.

Its specific gravity is as 10 to 1. Sal. Ammonia  
is decomposed by Zinc, the Muriatic acid  
attracting it more strongly than the vol.  
alkali which escapes. Nitric acid is the proper  
solvent of Bismuth, the precipitate by  
alkali or Sp. Ven. is called Spanish or  
Pearl White which is used by the Ladies  
as a cosmetic, but is dangerous, & finally

leaves the skin yellow & wrinkled. Muriatic  
acid don't unite with Bismuth, but it dissolves slowly by the aid

On exposure to air it acquires a black colour.  
It unites readily with Sulphur. All the Metals  
unite more readily with Sulphur, after having  
having lost part of their  $\Delta$ . Zinc has no attraction  
to  $\Delta$ , but attracts  $\Delta$ . Veg. acids dissolve a portion of Zinc.  
Bismuth is a powerful flux for all earthy substances.  
Phosphoric acid don't dissolve Zinc.

Cobalt & Nickel come next, but Rush says nothing  
about them.



Simple Metals. Lead, its specific gravity  
is as 11 to 1. a pellicle appearing on the  
surface of melting lead is a sign of its  
tendency to calcination. Litharge is a calx  
of Lead; it has acquired the name of Gold  
from its deep Orange colour. Minium is  
made by bringing the flame in contact  
with the Litharge, & by keeping a great  
Lead under it. Sp. Vin. is composed of  $\Delta$ .  
acetic acid, & water. Sacchar. Saturni is  
a crystallized salt formed by dissolving  
Lead in Vinegar, from which it is separated  
by Alkalies & Lead. Ceruss is Lead corroded  
by Vinegar. Vinegar distilled from Sacchar.  
Saturni is very strong & acuthe & contains  
Sp. Vin. fort. That never was in it before.  
It strongly attracts  $\Delta$ . It strongly attracts  
Sulphur with which it unites, & forms a  
most refractory metal, that no fire can melt.  
Earthen Ware is glazed by dipping or washing  
in a solution of a calx of Lead, vegetable acids  
corrode this, hence it proves pernicious. Fat or  
Oil, by restoring  $\Delta$  to a calx of Lead reduces it  
to its metallic state, thus by burning Waxes.  
Alkalies have no action on Lead.



Experiment is made of equal parts of Arsenic,  
& Sulph<sup>r</sup>. Hepar. Sulph<sup>r</sup>. is formed of equal  
parts of Alkali & Sulph<sup>r</sup>. Sympathetic  
Ink is a solution of Sacchar. Saturni  
Water. which is written on paper & don't show  
at all, but black colour is given it by sprin-  
kling or washing it with a solution of Hepar  
Sulph<sup>r</sup>. or Experiment. Lead is dissolved in  
Wine by Experiment which makes it turbid.  
Paints & colours should be mixed with  
Water, because the Oil (or Theriacal essence &c.)  
gives the calx of lead in the Paints,  
& it turns them black. Vit. acid corrodes  
Lead; the Nitrous dissolves it. The calx unites with  
most earthy bodies. It don't vitrify clay. Several inflam-  
mable substances act on lead, with which the Theriacal  
Oils form the Official Plasters. It promotes calcination  
of Metals & is used to purify silver. It is found every where  
almost.  
Tin is white. Its specific gravity is like  
of Antimony. It is powerfully attracted by the  
Vit. acid. All the vegetable acids attract tin.  
Tin is most frequently combined with Arsenic.  
Alkalies have no action on it. It makes  
Metals brittle. It is the lightest of all metals.  
It is a silver coloured metal, not sonorous. It melts  
below a red heat. Alkalies have no action on tin.  
It is pernicious to use vessels made with tin.



No metal attracts Arsenic so much as Tin.  
The crackling of Tin plates, on bending  
them is owing to the Arsenic. It has a  
slender attraction to earthy bodies. It com-  
bined with Sulphur has a strong attrac-  
tion to Metals & destroys their mallea-  
bility. It is the basis of Pewter. Tin, Lead  
& Oil form Butter. The tin plates are  
made of Iron dipped in a solution of Tin.  
Tin is never found in its native state;  
its found mineralized with Sulphur. The  
only preparation of tin used in Medicine  
is Pulv. Stanni which is possessed of An-  
thelmintic Vertues, but they depend  
chiefly on its shape, acting mechanically.  
The Vit. & Muratic acids act on Tin but  
slowly. Stenters as an ingredient in Brass  
Cannon, & in Bells.

Croci Martis astringens, & aperiens differs only in de-  
gree of calcination. Red hot iron immediately melts  
by rubbing it with Sulphur. Mercurius is Iron cal-  
cined by moisture, Astringens, by fire. Pig Iron is  
Iron just melted from its Ore & quite brittle; this melted  
a second time & well hammered is called forged Iron or Bar.  
Steel is made by cementing Iron with charcoal dust.  
Steel is strengthened by annealing it, & cementing it with  
Oxide of iron bones.



Lect 29<sup>th</sup> Jan 2<sup>nd</sup> 1786. —

Iron is heavy, sonorous, of a darkish blue <sup>or grey</sup> colour, <sup>fields</sup>  
very ductile: it is made red hot, sooner than any <sup>other</sup> metal, but requires a white heat to <sup>be</sup> <sup>den</sup>  
melt it. It contracts a glassy coat just be- <sup>fore</sup> <sup>it</sup>  
fore it melts; a piece of Iron a little before <sup>only</sup>  
it melts, if taken out, & strongly blown <sup>in</sup>  
on melts instantly. It is composed of a Me-  
tallie, Saline, & earthy matter. It is remar-  
kable for being attracted by the magnet  
& striking fire with flint. Sul. Martis, <sup>ma</sup>  
Green Vit. or Copperas is a calx of Iron,  
& Vit. acid; it contains much water, which  
escaping from the copperas in a great heat,  
the copperas is a <sup>made</sup> pure calx of Iron. I get  
the name of Colcothar of Vitriol. Vitriol  
acid act on Iron violently sending forth  
fumes. Muriatic acid with water attracts  
it most strongly, & retains it most tenaciously.  
Muriatic acid becomes yellow by attracting Iron,  
hence Iron is known in bottles. Stains taken  
from linen only by the Muriatic acid. Vege-  
table acids act on it. Alkalis act on it. <sup>alkalis</sup>



is a calx of Iron, & is made by precipitating  
it from acids by alkalis. Iron on exposure  
to air, rust or calcines & acquires a reddish co-  
lour, by the action of the foreign particles  
in the air probably from the acid escaping  
from various fermenting matters. The  
deep blue colour of some earths, & of Lap. Lazuli  
is owing to <sup>a calx of</sup> Iron, & Inflammable bodies.

Nitre, & Sal. Ammon action Iron. Sal.  
Ammon. sublimed with Colethar, makes Flor.  
Mart. Calcareous Earths greatly facilitate  
the fusion of Iron. The red sparks produced  
by striking flint & steel together, are small  
particles of the Iron broken off, & by the  
heat excited by the violent collision, ~~and~~  
melt, & take fire on exposure to the air, &  
thus calcined, they are proved not to be particles  
of flint. The sparks appearing on striking  
two stones together, are owing to electricity,  
& have no heat & excite no inflammation.  
It strongly attracts Sulphur, by which it is  
turned black; by heat the S escapes, & the  
Nit. acid acts on the Iron, making Copperas.  
Earthquakes are occasioned by water coming  
in contact with Pyrites on the act of in-  
flammation & decomposition of this fire  
the becoming elastic in decomposition is



since an artificial one can be made by a  
mixture of Sulphur, Iron filings, & water; or  
Gun Powder. One cubic inch of Pyrites yields  
83 cubic inches of air. Water breaking in upon  
a bed of Pyrites in its decomposition, greatly in-  
creases the inflammation, by which it sudden-  
ly converted into a rare, elastic vapour, which  
together with the fixed air rendered suddenly  
elastic, by its expansibility bursts open  
caverns, removes large portions of Earth, sin-  
king some, elevating others, & producing a  
vast concussion & trembling of the Earth.

A simple shaking of the earth is caused only  
by the fixed air escaping & expanding; but  
when this cause is added to the sudden con-  
version of water into vapour, the worst of  
Earthquakes is caused, as that of Lisbon.

A certain quantity of water increases the  
heat & flame, but a greater extinguishes it.  
Countries bordering on the sea coast, are  
mostly infested with Earthquakes; & the soil  
around them is light, loamy & full of fissures.

Volcanos are owing to Pyritous or Bituminous  
matters moistened by water, i.e. sea water,  
as sea weeds & fishes have been ejected by

Hot Springs which are insipid & pure are  
probably caused by running over ground heated  
by the inflammation of Pyrites lying underneath.  
Water promotes the solution of the Iron in the Pyrites by its  
acid the  $\Delta$  is evolved & ignition ensues.



but those which have a foreign taste, are caused  
by the Vit. acid of the Pyrites during their  
decomposition, mixing with the water.  
Iron strongly attracts Phlogiston & Charcoal.  
Steel is made by laying rods of Iron in con-  
tact with Charcoal, which, by heat is con-  
verted into Phlogiston & enters the metal,  
& then suddenly cooling the rods in cold  
water; the more  $\Delta$  it has, the more brittle  
it is. It unites with all metals but  $\phi$ .  
& Lead. It is prevented from rusting by  
Oil, or a mixture of Oil & Lead; but the best  
thing is the superficial blue calx, it is  
covered with by heat. Water corrodes it, but  
best by the intervention of the fixed air.  
Vit. acid must be mixed with water, to dissolve it.  
& Gold, Silver, & Platina, are never found  
naturally combined with Iron.

It is precipitated of a black colour by acerb,  
astringent, vegetable matters. It is, that  
&c by depriving the Iron of its acid, deprive  
it of its black colour. Sp. Vin. & a few cloves  
are the best to preserve the colour of Ink.  
Sugar, & Gum. Arab. are also good for purpose.  
Pale Ink becomes black by exposure to air;  
& very black Ink becomes pale by exposure  
to air. Animal bodies only as Wool, Silk &c. are  
coloured black by Salub. & astringents, not linen & cotton.



The solution of Iron in the Muriatic acid yields  
Crystals like green Vit. All kinds of vege-  
table acids dissolve Iron, the solution at first  
green, then yellow, & deposits a calx called  
Ochre; - you see this about all Mineral Springs.  
The best steel is composed of grains. The black  
colour which a solution of Iron strikes with  
some vegetables, is looked upon as the test of an  
astringent, but it is not certain, as Rue which is  
bitter & not at all astringent, strikes a <sup>very</sup> black co-  
lour with Iron, & Gentian which has some astring-  
ency strikes a very fine black colour. The Tink  
made by Linet is the best, i.e. one part of Sal.  
Mart. one part of logwood, three parts of Galles  
& one & half of Gum Arab. to 40 parts of water.  
All black Dyes are made in a similar manner.  
Leather is blackened & Cloths are coloured black by  
first dipping them in an astringent solution,  
& then in a solution of Copperas. The reason  
that Earthquakes are not so frequent in Ber-  
mudas as formerly is that the island is more in-  
habited at present, & a great number of deep  
wells dug, some 60 feet deep which serve as con-  
ductors for the fixed air & confined vapours to escape.  
The Vit. acid is essentially necessary to form  
Tink.



Let 30<sup>th</sup> Iron is found in every part  
of the Globe, & combined with most bodies as  
Clays Chalks &c. which owe their red,  
yellow, & blue colour to it. Waller found  
it in human bones. It is found in the  
form of a calx in the Blue Earths, & Lap.  
lazuli into whose composition enters  $\Delta$ .  
Iron & Alkali. It is never found native.  
Emery is a very refractory Ore of Iron. It  
Mineralized with Sulphur, & Arsenic  
alone or mixed together, from which it  
separated by Roasting, previous to it  
being melted to form Pig or cast Iron.

Lead Stone is Iron mineralised with Sulph<sup>r</sup>.  
Iron deprived of its  $\Delta$  don't attract  $\gamma$  Magnets.  
The rust & filings of Iron & Steel are both  
the same in Medicinal Virtues. It given  
from  $\mathcal{J}$  to  $\mathcal{Z}$ ss. at a dose without inconvenience.  
Cast Iron is neither malleable nor ductile,  
but when annealed, or heated & gradually  
cooled, & then beat out into bars, it possesses  
both Malleability & ductility, then called wrought  
Iron. Iron is divided into Cast & wrought Iron,  
& Steel.



Copper is almost as hard as Iron, very malleable & ductile, but don't possess as much Δ as Iron. It don't easily calcine. Its calx is green. It receives more heat, than any other Metal. Melted Copper thrown into water, is got in grains, which are most conveniently used to form diff. Metals.

It calcined most easily below the point of fusion. It dissolved & corroded by almost all the Salts.

Nit. acid dissolves it by heat forming Blue Vitriol.

It always contains some Iron. Blue Vitriol is got from Copper Pyrites. Nit. acid act on it powerfully. Muriatic acid act on it slowly.

Vegetable acids don't act on it readily in its Metallic state; but when previously converted into a ceruse, they unite with it making Verdigrase; which is highly sedative, & used in Ointments for scalds, or Burns. Vegetable substances as conserves, preserves &c whilst boiling don't corrode the copper vessels in which they are, but after they grow cool they do, by reason of the Copper being then corroded by the access of the air. Distilled Verdigrase is an improper name for it only the crystals of Verdigrase dissolved in Vegetable acids.



The Vinegar is obtained in a highly concen-  
trated form from Copper only, by heat  
alone. It is precipitated by Vol. Alkali  
of a most beautiful deep blue colour,  
which disappears by adding more acid.  
The Vol. Alkali should abound, in the  
above precipitate. The colour will dis-  
appear unless the mixture is exposed  
to the air. Its colour is owing to  $\Delta$ . Cuprum.  
Ammon. is made by dissolving Vit. Corul.  
Ziv. in warm water, then adding enough  
of Vol. Alkali to precipitate & dissolve  
it, & then an equal quantity of  $\mu$ . Viri.  
Fixed alkali dissolves it not so readily as  
Vol. Alkali. Nitre deflagrates with it.  
Ag. Sapphirin. is made by rubbing Ag. calc.  
& Sal. Ammon in a Brass Mortar.  
It attracts Arsenic. It unites with  $\phi$ .  
only after  $\phi$ . is precipitated from its  
solution in the acid. Cus Venus is  
made by subliming Copper with  
Sal. Ammon. Copper unites with  
Sulphur, & several of the Oils. Iron  
is employed to precipitate it from its  
solution, which it does by restoring it  $\Delta$ .



of attracting its acid; thus there is a River  
in Germany which flows over a bed of  
Copper Pyrites, that converts (as the Vulgar  
say) Iron into copper; but the truth is,  
the Iron gives the copper its Plegiston, &  
attracts the acid that held it in solution,  
& the copper precipitates on the Iron, which  
contracts a blue colour. It unites with  
all the other Metals. All the imitations  
of Gold are made of Copper & Zinc.

Brass & Tin form the Metals that ad-  
mit of a very high polish, & of which,  
Bells, Telescopes &c are made. The lead  
must boil to mix with copper, which it  
does with great noise. It is rusted by the  
Air found in all parts of the world. The blue  
or green colour of the ground is a test of  
Copper. It is seldom found native, mostly  
in the state of a calx, with Earth or Iron.

Gold & Silver are the perfect or Noble Metals. They  
resemble each other in respect to  $\gamma$  Malleab. & Ductibility.  
They are incorruptible by air & less acted on by  
the agents of Chemistry. They are unchanged by  $\gamma$   
most intense heat, but the concentrated rays of  $\gamma$   
Sun convert them partly into vapours, & partly  
into a glassy substance.



Nitre don't act on them. The acids act on them, & demonstrate the presence of Phlogiston. If calcined they may be reduced without addition of Phlogiston: this is effected by exposing them to the rays of light, this shows that light & Heat are the same but differently modified or diff. forms of the same body. They strongly attract Phlogiston. Their Phlogiston adheres to them very strongly. They are obtained from their ores by cuppelling; the cuppells absorb all the scoria of the lead which have no action on Gold & thus leave it pure. In this manner 34 of Gold may be got out of 1000 of lead. It is more difficult to separate Gold from Silver.

Silver don't rust in the air unless an acid floats in it. It may be melted in a less heat than copper; when cooling, it vegetates or sprouts into branches. The Vit. acid, if applied boiling to Silver, dissolves it. Water must be added to Ag. ferd. or Nit. acid to dissolve Silver, & then it dissolves double its weight of Silver. The colour depends on the Silver remaining in it. The Silver thus dissolved, forms the Vit. acid by separating its acid, melting it & pouring it into Moulds.



Muriatic acid acts more strongly on Silver than the other acids; it acts most on the calx of Silver. The solution of Silver in the Nit. acid is used as a test to discover the presence of Salt in water, which, if it contains the Muriatic acid or sal. com. becomes turbid, & the Silver precipitates.

Vinegar acts on it in its calcined state. It becomes by attracting Phlogiston. It unites with Sulphur & all the metals but Nickel. It strongly attracts Copper, Lead & Gold. It is found chiefly in S. America; Native, or Mineralised with Sulphur, Sulphur & Arsenic, Sulphur & Iron, Sulphur & Copper, & Copper & Arsenic. & Antimony, Zinc, Lead & Acid of Common Salt. —

Sulphur greatly accelerates the fusion of Silver.

Leck. 35. Gold is a pure, soft metal of a yellow colour, & of little elasticity. It becomes whitish by Lead, probably because it made purer. Its specific gravity is as 19 or 20 to 1. It burns in the fire & melts in a white heat. With the addition of Quick Lime & Potash, it is calcined by Lead. It contracts <sup>little</sup> after being fused. Fire don't act on it. It is extremely ductile.



Gold Smiths detect Gold by the touch stone,  
the suspected metal is rubbed on the  
stone, & the mark it leaves, (if it's of any  
other metal besides gold) is totally obliterated  
by Aqua fortis, but if it's Gold, Ag. fort  
will have no action on it. Acid in this  
simple state don't act on Gold. Aqua  
Regia is the proper solvent of Gold; it's  
made by mixing one part of Common  
Salt with four parts of Ag. fort. without  
heat. This Solution is always of a bright  
yellow colour. Muriatic acid only acts  
on the calx of Gold. The solution of Gold  
stains all animal substances of a deep  
blue colour. By evaporation, part of the  
Gold & Muriatic acid is carried off.

Aurum Fulminans is Gold precipitated  
from its solution by fixed or Vol. Alkali.  
It's capable of great explosion by heat. This  
is owing to the fixed air it contains being  
suddenly converted into vital air.  
This precipitate is one fourth heavier,  
before dissolved, owing to  
the quantity of fixed air it contains.



Its explosive power is destroyed by wash-  
ing it with water, mixing it with  
Sulphur Vit. acid or fixed alkali.  
The flash occasioned by exploding Aur. fulm.  
is the collision of the air from the sudden  
explosion of fixed air. It is separated from  
Ag. by  $\Delta$  without heat, & is precipita-  
ted by Mercury, Tin, & Green Vit. which  
act by attracting the Muriatic acid. Certain  
bodies are tinged of a beautiful, purple  
colour by Gold in solution. Sulphur re-  
converts Gold in Aur. fulm. by giving it  $\Delta$ .  
The Sulph. with regulus of Antimony is the best  
it does unite with Gold. Neph. Sulph.  
dissolves Gold, & forms a bitter solution. Gold  
unites with all the Metals. It amalga-  
mates with  $\frac{1}{2}$  Mercury strongly attracts  
Gold & deserts all other metals to unite with  
it. It is mixed with Silver & Copper which  
make it much harder, & are called Alloys.  
Tin destroys the colour of Gold, & many  
other properties; 1 gr. of Tin affects 100 grains  
of Gold. Perfectly pure Gold is said to be  
24 carats fine. It is found never in a pure  
& separate state. It is found in S. America  
& W. India & diffused through sand in Africa



Air is divided into 1. Fixed, 2. Inflammable, 3. Dephlogisticated, 4. Common, 5. Phlogisticated, 6. Vit. acid, 7. Nit. acid, 8. Muriatic acid, 9. Alkaline, 10. Hepatic.

Fixed, & Phlogisticated air, & Muriatic acid are synonymous & exactly the same. It is proved to be acid from the acid taste of Spa & Pyrmont water, which are highly impregnated with fixed air, & from its turning R. Turnsol. red.

Black says it is a composition of Vital or Dephlogisticated air & Phlogiston.

It is expelled from all bodies by heat & from water when freezing. Fresh water is got from Salt water by freezing it is none but the fresh will freeze. It is the weakest of all acids.



It exists in fixed & volatile alkalis, & unites  
greedily with Calcareous & Gypsaceous Earths  
which latter are called Terra Ponderosa.  
Quick Lime becomes soluble in water  
from an over or under proportion of fixed air.  
It unites readily with S. W. Oil &  
Other, & renders Iron & Zinc soluble in  
water. It is soluble in water. Sp.  
Pyrmont, & Saratoga waters, as well  
as those artificially impregnated with  
fixed air promote fermentation,  
& are used to make Bread instead  
of Yeast.

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It is fatal to animals, & extinguishes flame.  
The lungs of those who die by breathing  
fixed air are collapsed like those which  
have never breathed, & they sink in  
water. In this manner it kills. Mixed  
with water it makes a fine & refreshing  
drink & with Wine adds greatly to its  
flavour & excellence. It is found in caves  
& there called Cloak Damp, in Mine  
cells. It is what grows so fatal to  
Lungs in a sort of delirium, it rises about



Two feet above its surface: no explosion  
is heard from firing a pistol in it. &  
the smoke of any thing don't rise in it  
but passes along horizontally. It  
extricated from bodies during fermenta-  
tion & rises only about half a foot above  
its surface. It extricated from Earths,  
& burning bodies: That from burning  
bodies is called by Priestley, Phlogistic-  
ated air, tho' in fact they are both  
the same, & exactly similar to that  
coming from the lungs of animals.  
It is a mild alkali is fixed air. It has no remarkable  
action on Acid or Neutral Salts. Charcoal  
contains it in the greatest quantity of all in-  
flammable bodies. The virtues of Pyrmont water  
depend on this.

Art. 32<sup>nd</sup>. Inflammable air is pure  
Phlogiston combined with a certain  
quantity of Vital air. Pure Phlogiston  
separate & uncombined is incapable  
of inflammation. Its specific gravity  
is as 1 to 10. Combined with Dephlo-  
gisticated air, it becomes very suscep-  
tible of inflammation. It takes



fire with an explosion. It obtained  
in the greatest quantity from Metals.  
The vapour issuing from a mixture of  
Vit. acid & Lime, is inflammable air,  
& flames & explodes by touching it with  
the flame of a candle. The flame is  
remarkably bright & vivid. It is one of the  
materials of Balloons; which are filled  
with rarefied & inflammable air. It  
chiefly got from Lime & Iron. It refuses  
to mix with water. Caves contain it, &  
then it is called a fire Damp. The Mines  
in Cornwall abound with it, & light  
is supplied the Workmen by a steel  
wheel rolling upon flints. Intestinal  
air is inflammable air, & is vacuated  
by Faeces — 9. Dephlogisticated, Vit. air,  
Empyreal or Respirable air is the  
sole *Pabulum Vitae*, & *Ignis*, forms  $\frac{1}{4}$  of  
our Atmosphere, & a Person can breathe  
in it five times as long as in common air.  
It uncommonly exhilarating, abundantly  
more so than Wine. Nature secretes  
it plentifully from Vegetables, which  
in the Night imbibe fixed & common air,  
& on the Day time, discharge dephlogisticated,  
by the influence of the rays of light —



There are for this season necessary in  
large cities & near dwelling houses;  
few trees are necessary as too many  
would impede the sun's rays from  
falling upon some of them & they  
are thus productive of the disadvantage  
they were meant to remedy. Mountains  
altho' looked upon as deformities in  
the great book of Nature are absolutely  
necessary to our existence for the trees  
& shrubs growing on them discharge  
dephlogisticated air. The artificial  
sources of this air are Nitre, red  
precipitate, red lead & calothar of Nit.  
But it is got from Nitre chiefly.  
Phlogisticated air is Impure air  
charged with a certain proportion of  
Phlogiston. It is the same as fixed air  
only in a more diluted state. The  
fixed air is in a more concentrated state.  
Common air is compounded of  
 $\frac{1}{4}$  Dephlogisticated air, &  $\frac{3}{4}$  of Phlogisticated  
air. It is very heterogeneous & contains  
many impurities. Miasmata &



Contagions which are the causes of so many Diseases, & Odours of various kinds all enter into mixture with the Common Air. The fat air is met with in Mineral waters; Harrogate contains it in great quantity. The division of air is too minute & particular. The acid & alkaline airs are nothing but the particles of those bodies floating in the air.

Fixed air is produced by fire which evolves Phlogiston. That mixed with vital air forms fixed air. Fixed air nourishes Plants, is a sedative & antientic. A great quantity of it is extricated during Digestion. May not the sleepiness after a full meal be owing to the fixed air. Vinegar destroys the effects of fixed air.

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Deny that every plant possesses a medicinal & nutritive quality, some are for food, some for Medicine, & others merely to adorn the Earth. The variety of substances in plants may be referred to 3 kinds viz. 1. The solid woods, Fibres, Gum; 2. Aromatic Oil or Balsam; 3. Resin, Stomachic Oil, 4. Salt, Sugar, 5. Straginous substances.



The properties of Water are Weight, Pressure,  
& Fluidity which belong to Mechanics.  
No natural water is perfectly pure, &  
<sup>it is a mixed body</sup> homogeneous. Boyle first taught that  
water might be converted into Earth; hence  
the increase of Islands & Lands bordering on  
the sea. They increase mostly on that side  
most exposed to the wind. There is not one  
particle less of water now than was at the  
creation; it suffers no diminution, but  
is supplied by Vegetables & Animals. The  
Water is not changed into earth, for the  
particles of Earth pre-existed in the water  
diffused & are only deposited. It is divided  
into Common & Mineral pure water.  
Pure water is always ultimately the same.  
They are Celestial as Snow, Hail, Dew, &  
Rain; & Terrestrial as River, Spring,  
Lakes &c. Its purity depends on the parts  
it falls on, & the land it runs over. They  
are the most impure in Autumn. Im-  
pure water may contain a Vegetable or  
Animal matter, which fermenting leaves  
the water perfectly pure & transparent.  
The yellow matter brought by Rain sometimes,  
is the farina or pollen of seeds carried up by  
the wind & brought down by rain. Each grain is  
an organized body, & the embryo of a plant.



It is insoluble in Water, & Spirit of Wine. The colour of the Red Sea is owing to the Red Sand diffused through it. Rain Water is often of a red colour owing to the animal matter it contains.

Lect<sup>1<sup>st</sup></sup> 33<sup>rd</sup>. Mineral Waters are divided into Simple, & compound. The only acid Waters there is the Vitriolic, which they get by flowing over Pyrites <sup>by effluviating with alkalis</sup>. It is discovered by a sour taste, by striking a red colour with Sy. V. Viol. or R. Turned by becoming turbid on mixing it with a solution of Lead in Nit. acid or Ferri gas, on account of the Vit. acid's strong attraction for Lead. Of the Alkalis, the fossil only is found in Mineral Waters, mixed with calcareous earths or Magnesia. It is detected by the pungent taste, by effervescing with Acids, striking a green colour with R. Turned by becoming turbid by mixing it with Sal. Am. fix. by precipitating it with sub. in solution of an Orange colour, & by precipitating the Copper from a solution of Blue Vitriol. Quick lime is soluble in water when entirely deprived of fixed acid, & when it abounds with it.



Did Sugar discover the smaller quantity of Lime.

Calcareous earths are known by the  
turbid & whitish appearance of the  
water, its flat taste, by adding a  
solution of P. corros. sub. the P. is  
precipitated of a yellow colour; & by  
adding H. N. a white form. &  
The earth of Alum & other class is

found in Mineral waters, known  
by forming Alum with H. N. acid.

Sulphur & Fogel Oil are the only  
inflammables found in waters. They  
are known by their taste, smell &  
inflammability. There is not an

atom of Sulph. in waters, but  
only a suspended air, which is only

the principle of inflammability  
of the sulphur extricated during  
its decomposition, mixed with

the water with a portion of fixed  
air. It is known by turning silver  
of a black colour & colouring the

which it does by the principle of in-  
flammability. Petroleum is only  
found floating on the water unless  
formed into a soap by uniting with alkali  
& then mixing with the water.

By Detaching of fixed  
air.



Iron & Copper are the only Metals  
found in Mineral Waters. They are  
held in solution by means of fixed air.  
The Iron is known by adding a vege-  
table astringent & structure of solution,  
the Prussian alkali, or by precipi-  
tating it by extracting of fixed air,  
also by its colouring the white of an  
egg yellow, & by adding a solution of  
Silver in Nitric acid, which is precipitated.  
It is common in most animal & vege-  
table bodies, being conveyed in by water.  
Copper is dissolved by water forming  
a green & blue colour. It is known  
by adding Pot. alkali which dissolves  
it, forming a blue mixture, & pre-  
cipitates it, & by turning Iron  
Copper Compound. It true Glauber's  
Salt is never found in Mineral Wa-  
ters. Vitriol, but what has been taken  
for it is Sal. Epsom which is in M.  
Waters. It is known by adding an Alkali  
which makes it turbid & precipitates it  
Magnesia. Sal. Common. is often



found in them. It is detected by adding a solution of silver in Vit. acid, & by evaporation. Selenites & Alum are found in waters. The former is known by evaporation, & by an alkali making it turbid & precipitating the earth. The latter is known by a solution of Borax turning the water of a white milky colour, & precipitating the clay. <sup>Also by an alkali & lime.</sup> Vital air is always present in water. Fixed air is generated from Alkalis & Calcareous Earths. It is known in waters by their fatal effect on Animals, extinguishing fire, pungent taste, & rendering Caustic Alkali mild. Green, Blue & White Vit. are in waters. <sup>by common Prussian Alkali.</sup> The green is discovered as Iron, the Blue as Copper, & the White by an Alkali. — An Horn possesses the stamina of an oak.

Vegetables are organised Bodies, endowed with Sensibility & Irritability. They are produced from their original stamina.



They are nourished by <sup>simple</sup> water. Water in  
which animals & Vegetable matters are  
dissolved, undergoes a very dangerous  
~~fermentation~~ fermentation & the gas extricated is very  
inflammable. The same vessels that  
imbibe in Plants perspire also. There is  
no reciprocal circulation. None grow  
in a few degrees above animal heat, or  
where wax melted will remain fluid;  
nor in a few degrees below the freezing point.  
Evergreen is an exception to this rule;  
~~but~~ seeds contain an Oil.  
Too much moisture is destructive to vege-  
tation. The best fruit are in dry sum-  
mers, & that grow in sandy soil. The  
root should be uncovered, & cutting away  
part of the bark also favours the growth.  
There is no anastomosis in the vessels  
of plants. It is no way analogous to  
the circulation of Animals. Water is  
the only nutriment of plants. They  
have Nerves & a nervous system.  
The Sap don't rise by capillary attrac-  
tion. Sensitive plant is an instance of  
sensitivity & irritability. The green  
colour of plants is owing to the light  
their nerves are tubular.



alone. They all have a partiality  
for light as is evident <sup>by the sun flower,</sup> by the boughs  
of trees, &c. inclining to the South.  
by a confined Vegetable bending to the  
place that has the most light. They  
seek the rays of light. Air is absolute-  
ly necessary for vegetation. By che-  
mical analysis, they yield Water,  
Air, Oil, Salt & a starchy matter  
or Earth. Sugar is no salt; as it is  
not capable of fusion, & is liable to fer-  
ment. Cutting trees prevents their fruit rot-  
ting, by letting out the superfluous moisture.

Those Maples that grow on Hills  
yield the most Sugar. Eleven gal-  
lons of juice give 1 lb of sugar. They  
also yield Molasses, Vinegar & kind.

Fermentation is a gradual intestine  
motion between <sup>the component particles of</sup> heterogeneous matters  
with an extrication of <sup>generation of</sup> acid & heat.

It should be between 70 & 80 degrees  
of F. Thermometer. Moisture &  
Heat are absolutely necessary  
for fermentation.



In the Vinous fermentation there is  
great heat, a large quantity of air &  
great intumescence; much greater than  
in either of the others; as is evident in  
Hay stacks lying set on fire, by it.

There is no heat in the Putrefactive,  
but a great discharge of Malignity,  
as in Water casks long confined.

Bilge water tarnishes Silver by  
the quantity of  $\Delta$  it contains.

The P. ferment. is hastened by Putrid  
matters, the acetic by tartar, & the  
Vinous by yeast. The generation of

Heat is confined to the Vinous fer-  
mentation. The greater the quantity  
of Sugar, the more rapid the V. ferment.  
& the greater the Mucilage, the more  
rapid the Acetic fermentation.

The original stamina of all plants moderate  
fibres as may be seen in the bark, that is fibrous.

Lect. 34. Bread is one product of fer-  
mentation. It is the most universal of  
Aliments. It is made of the first product  
of fermentation. It is either leavened or un-  
leavened. The latter is the most ancient. It  
is made of Flour, Water, & Salt. The leavened  
is made with yeast which is the second that



arises from Beer. During the various fermentation  
the French bread is the lightest. It is made of half a  
bushel of flower, the yolks of ten eggs,  $\frac{1}{2}$  lb  
of Butter, & as much yeast. The yeast may  
be preserved by evaporating it to a solid mass.

Beer is the product of fermentation.  
That most generally used, is prepared  
from Barley. It is made in the fol-  
lowing manner; viz. the barley is first  
soaked in water for 3 days. then laid in  
heaps in a warm place till it begins to  
vegetate. this is sweet; this is now dried & bruised  
in a mill. this is called Malt, which being  
mashed & infused in Water is called Wort.  
Hops being a bitter are added to prevent the  
fermentation, after ferment: it is put into barrels.

It is forbidden in debilitated habit, &  
in stomachs tending to acidity.

Porter is better, on account of its age,  
& having undergone a more complete  
fermentation & deposition of its impurities.

Wine is a product of fermentation.  
Those made in warm climates are  
sweeter, & less austere than others. They  
are all originally of the same species.  
The difference depends on nothing but  
the variety of soil & difference of culture.



The sweet are made from the dry grapes; hence sack from sic signifying dry; & the sour & austere from grapes when just ripe or before <sup>ripe</sup>. Must is the juice recently pressed from the grape; this is converted into Wine by undergoing the Vinous fermentation, which is checked after a while. The Wine, in order to its perfection, should be exposed to the Sun's rays, which renew the fermentation of the Must or Saccharine Part, that has not yet undergone it, & thereby generate more pure spirit, & prevent the acetous fermentation. I believe it would be much better if the Wine were exposed for six months to intense heat, & six Months to intense cold, than if it were kept in one uniform temperature. Dry, warm seasons are the most favourable to the production of good Wines. The Garret is the best part of the House, for them to ~~live~~ lie in. Motion in whatever manner it is performed, greatly improves them. But the motion of vessels in



long sea voyages is the best, as they are  
kept warm in the holds of the vessels,  
& if they go to warm climates to the  
warmth of the Sun. It is greatly im-  
proved also by stowing the Hods, among  
Hods of Sugar, for the Saccharine matter  
perspires through the Hods, & mixes with  
the Wine. This attraction is exemplified  
in Apples & Turnips; a quantity of  
Newtown Pippins being put with  
Turnips in the Earth, the attraction  
between them is so great, that the  
Apples will taste quite strong of  
the Turnips. Vegetable Saccha-  
rine Matter greatly improves Wine.  
A neck or collar of Beef, also adds  
greatly to the strength, & quality of  
Wine. Wine is refined in 3 ways,  
viz. 1. Rest; 2. Mechanical means, as  
Sand, Brown Paper, or the Whites  
of Eggs; 3. Chemical Means as Alum,  
Sunglass, & Milk. The turbidness  
of Wine is owing to the unfermented  
Matter fermenting. Sand gives Wine,



by its particles attracting those of the  
Mud & falling to the bottom. The Whites  
of Eggs also & Brown Paper by entangling  
the impurities & falling to the bottom.  
The fermentation of the weak Wines stops  
in the Putous, Brandy will prevent this.  
The strongest of Wines is Sherry, then  
Madira, Fayal, Teneriffe, Lisbon. Of  
the Red, Port, Claret, Burgundy which  
is divided into red & white & above fifty  
other kinds. Of the sweet, Muscat,  
Malaga, Sack. Of the sour, Aus-  
ten, Rhénish, Hock &c. This differ-  
ence only depend on the diff. propor-  
tions of Putous acid, Muri or saccharine  
part, Water, & inflammable part, Spirit  
& Oil. The first contain more sugar,  
Spirit & less water, the acid is much blunted.  
The sweet Wines much mud & water, but  
little acid. The Red, sour, & austere much  
acid, water & spirit but little mud.  
Madira Wine passes off by perspiration  
& Urine unchanged but only diluted,  
not at all decomposed, hence Claret  
or Madira is the test for weak, acrid  
Stomachs.



The best water to make beer of, is that  
which is loaded with the most filth, hence  
the superiority of the English Porter  
because it is made of the Thames water.  
Pond & River water are the best. It has  
long been remarked that October beer  
is the best, because in this Month of October  
the water of the River is more impreg-  
nated with putrid animal & vegetable  
matter, which fermenting, hastens &  
completes the fermentation of the  
beer: the impurities of the water sub-  
side to the bottom & carry with them  
those of the beer, leaving it perfectly  
pure. Sugar is highly antiseptic,  
it is produced from the sugar cane in  
the greatest quantities. The farina  
resembles sugar, it is liable to ferment,  
is soluble in warm water but not  
in cold, it is contained in the seed of  
some plants, & in the root of others.  
The Cerealium contain the greatest quan-  
tity. They never grow wild. Plants suffer  
a transmutation.



All bodies resolved by Putrefaction part with  
the principle of inflammability: as instances  
in Light Wood. Vegetables if left to them-  
selves undergo the Vinous, Acetous & Putre-  
factive fermentation, but they may be in-  
creased by ferments. Herb Wines are  
made from unripe grapes. Very cold &  
very damp weather make good old Wine  
turbid & unfit to drink.

Spirits are produced by distilling Vege-  
tables in the Vinous fermentation. They  
may be procured from any substance  
capable of undergoing the acetous fer-  
mentation. All the Cerealia, Corn-  
stalks, Raws, Peaches & other fruit yield  
it by distillation. The Grain that grows  
in old ground, & in dry seasons produces  
most Spirits. Lime checks fermentation.  
The Spirit made here is made from  
Molasses, or Cyder. The proportion for  
making Spirit, or Rum, is 100 Gallons  
of Molasses, 300 Gallons of water & 400  
Gallons of Returns; the matter remain-  
ing in the still after distilling Rum, is  
the Return & is a true Vinous ferment.  
Pell. Jalap hastens the fermentation.



An Hydrometer tells the strength  
of Wines & Spirits. Vinegar is made  
of any liquor capable of undergoing the  
Acetic fermentation. Accelerated  
by adding Molasses or Tartar...

Bread is improper for very weak  
Stomachs. Almost every Nation  
in the World makes use of some kind  
of fermented liquor. Intemperance  
in Eating produces a necessity of  
Drinking to correct the tendency  
of our fluids to putrefaction. But  
most in England, it is pernicious in  
Nephritic complaints. Wine is  
most drank in Germany & France;  
Cyder is most drank in America.  
Spirits is very hurtful to the system.  
Simple Vegetable Diet & Milk are  
very good in Old People whose sto-  
machs have not been debauched & weak-  
ened by drinking Spirits; but those  
who have drank much Spirits will  
invariably tell you that Milk turns  
sour on their stomachs & disagrees with  
them.



A German Kitchen or Cookery is  
much the best. More Vinegar, & less  
butter would be much more favourable  
to our healths, than the reverse which  
we follow. Wine is composed of Alcohol, Malt,  
Water, & acetic acid. The sweet Wines are the  
most nutritious. Substances are nutritious in  
the following degree. 1. Sugar, 2. Oil, 3. Maltage  
i.e. Sugar is the most nutritious of all sub-  
stances, then Oil is next, & Maltage is  
the least nutritious. Beer is the best drink  
for labouring people on account of the quan-  
tity of Malt it contains. Porter is the best on  
account of its age & purity, but also because it  
is more bitter, & the fermentation is more  
complete as it is made with the most impure  
water. Brandy is added to Wines to prevent  
their growing sour, & to prevent the acetic ferment.  
Cyder contains much water which is its  
Basis, must, much acetic acid, & very little  
Alcohol. By Racking it, it becomes more  
concentrated, & deprived of its watery parts.  
By reducing two barrels of Cyder to one  
by boiling, & keeping it several years, it  
becomes equal to Lisbon Wine. It is a good cordial



Lect: 35. The Human Body is divided  
into Solids & fluids. The Solids yield by a  
Chemical analysis. Water, Salt, Oil & Earth.  
The Salt is a Volatile alkali which is a dis-  
tinguishing characteristic between Animals &  
Vegetables, the Oil too has a peculiar odour.  
The fluids have the same principles as  
the solids, but in different proportions.  
Blood when circulating appears to be a  
simple, homogeneous mass. That it first  
escapes from it in vapour, & the blood separates  
into Serum, & Cruor or Crassamentum, a  
solid red mass. The Crassamentum is the more watery  
particly as is evident to the sight from the  
weight & bulk being diminished, this is  
increased in quantity from the heat of the  
blood, & size of the vessels. The crassamentum  
is made of red globules or more properly visi-  
cles, & Coagulable lymph. This last forms the  
Buffy or icky coat, in Phlegmasia; it is detached  
from the red globules, which by their superior  
gravity fall to the bottom. Blood is divided  
into Serum, Red globules & Coagulable lymph;  
they are diffused together by means of heat;  
the red globules are diffused thro' the coagulab. lymph.



The Serum appears homogeneous too, but is  
in fact heterogeneous, being composed of Water,  
& coagulable Lymph. The reason of the red Globules  
being separate, is that they are not miscible with  
the other parts of the blood; just as Alcohol & aqueous  
alkali always remain separate, let them  
be never so well agitated. Red Globules are  
not Oil, but water rather; they are inflammable,  
as also is the coagulable Lymph. The deep  
black colour of the inferior surface of the  
Crassamentum, is owing to the greater con-  
cretion of the Globules, & not as has been im-  
agined to the absence of the air. The neutral  
Salts prevent the separation of the blood, by  
mixing the Globules, & water more intimately,  
& the Vinegar increases the firmness of the  
crust by separating the water more inti-  
mately. The blood acquires its red colour  
from the dephlogesticated air we inspire.  
Kams cured by Sal. Nitr. are not improved  
by it, but only coloured red. The red Globules  
assist in secretion, greatly forward the  
growth of the animal, keep the coagu-  
lable Lymph separate, & prevent its concretion.  
The coag. Lymph is very like the White of egg.  
They both coagulate in  $150^{\circ}$  of heat, are coagulated



by the same acids, & both serve for the nourishment of an animal body. The white of an egg differs from it in never coagulating in the cold, & in being more bland, but contains no saline matter as the Serum does. They are in short the same. The buffy coat is not an infallible sign of inflammation, as it depends on the shape & quality of the vessels, & the warmth of the place it is kept in; thus if received in a conical vessel there is more coagulable lymph, than if received in broad, flat bottomed vessels & if received in earthen vessels more than in other kind: but the greatest quantity of buffy is always present in Pleurmasia; it owing to the increased action of the Heart & Livers. The coagulable lymph, & red globules separate in 3 ways viz.

When an Artery is deprived of the fine fluid which is secreted on the internal surfaces of all the arteries, it attracts the coagulable lymph, & forms Polypus. Hemorrhages are stopped by a thrombus



plugging up the vessels, which is nothing  
but the coagulab<sup>l</sup> Lymph concreted. Dry sub-  
stances are proper applications to stop  
Hæmorrhages; as Flour, which is one of the  
best: They act by absorbing the Serum,  
& suffering the C. Lymph to concret.

Fluid applications are absurd. Serum  
is Water & Salt of an Ammoniac kind, some  
of Vol<sup>l</sup> Alkali, & acid of Urine or Phospho-  
rus, with a portion of coag<sup>l</sup> Lymph dis-  
solved in it, called Serosity. Mucus is  
the more volatile & watery part of the  
Serum. No chyle enters into the com-  
position of the blood: the Milk is received  
from the chyle. Oil does not formally  
enter the blood. Air is present in the  
blood in a semi elastic state, as it is  
in water for by taking off the pressure  
of the Atmosphere the water rises. The  
Cellular Membrane almost con-  
tains air which is secreted into it  
for some particular purpose. To the  
state of this air, several diseases may  
be owing.



Lect. 36.

The doctrine of tenor & viscosity in fever is absurd & without the least foundation in truth. There is the greatest quantity of red globules & coagulable lymph in healthy, vigorous animals, in Plethoric habits, & inflammatory Diseases. Surts of the abdominal viscera are generally produced by a too free use of spirituous liquors, whose action, like that of Opium is narcotic, & confined to the Nervous system. The blood is never diseased from having its density or tenacity increased. Diet can't alter the blood, for the aliment is perfectly changed previous in the stomach, previous to its entering the mass of blood. In proportion as the excretions are diminished, absorption is increased. Tenacity can't take place from watery drinks, for when these are increased, the excretions are increased; the Blood of a Tropical Person is not watery. It may take place for a short time in the Ischuria Renalis, but this will be only until some other excretion is increased. This may take place in the sweat, but then it's owing to a dyscrasia of the blood, the coag. lymph being dissolved by the serum. Of acrimony in the blood, the Oil in the cellular membrane would envelope it; thus in Hunger when the juices from the want of a fresh supply, become acrid or from other causes, the fat is absorbed to afford nutriment & soothe the acrimony. The action of the Heart & Arteries is never increased by acrimony in the blood. There is never a direct stimulus to the



Hard in a living body; in this situation it is insensible  
to a stimulus in the blood. The blood is sometimes very  
acrimonious, as in the scurvy, which is owing to a pre-  
dominance of Ammoniacal salt but here the pulse is  
not at all increased but sometimes rather slower in  
health. No acid exists formally in the blood, for 1. The bile  
destroys it as acid & bitterness, mutually corrupt each other, 2  
The absorbents wouldn't admit it, 3 The juices in the intes-  
tines would destroy it, 4 It would be destroyed by mixing in  
the blood. The Milk yields an acid but this is owing to  
Milk fermenting. No acid & matter happens in fevers. Scum  
turns the syr. of ~~Violet~~ <sup>green</sup> but it is owing to a mixture of  
blue & yellow colours. No fixed alkali is ever present formally  
in the blood; but it is produced by fire: it is neutralized by  
the acid in the stomach, & changed into Vol. alkali  
on entering the blood. Common Salt is changed into an Ammon.  
Salt in the blood, & Glauber changed it into Nitre, this is done in France.  
The fire produces fixed alkali. Green Tea taken in the Morning pro-  
duces the same effect as fixed alkali in the stone & gravel. Alkalies  
are given in the stone & gravel in great quantities, but don't exist in  
the blood in a formal state. Alkalies induce a solution of the blood,  
by destroying the acid in stomach, 'tis the abstraction of acid that  
gives the discolored blood in the stomach scurvy. The acid in the  
stomach is necessary to form the Animal juices. No Vol. alkali  
or Neutral salt ever exist formally in the blood, except an  
Ammoniacal salt which is always in the blood & Urine. Vol.  
alkali is never evolved from the body during life. Poisons always  
excite their effect by bringing on Stoma. Hence are successfully  
cured in France by Vol. alkali. The tetradynamia of Linnaeus,  
& Siliquosa of Raze yield Vol. alkali. Poisons produce a  
dissolution of the blood by acting as sedatives on the Nervous  
system; here the Vol. alkali act as in Putrid fevers, as a stimulant  
& antispasmodic. The Scurvy is induced by 1. stoppage of the excre-  
tions, 2 Want of Vegetables, 3 Abstinence, 4 Animal Diet, 5 too great  
quantity of salt taken into the body, 6 Passions of the mind, 7 Cold &  
Moisture. A fever is never produced by the irritation of Pus  
absorbed. In eruptions & Ulcers as the Tinea Capitis the  
matter don't preexist in the blood, but is formed in the  
part particularly. Cutaneous eruptions are cured by V.S.  
Cathartics, Discutients as Ung. Stemonii. Preparations of  
Lead &c. They act not by evacuating the acid matter, but  
by determining from the Surface & abating Plethora.



Veget. Diet is proper to deviate the predominant alkalis.  
Port is the best in surgery; two quarts may be taken a  
day. Fever always attends the last stage of all chronic  
diseases. De Haen has shown that Pus is formed ~~without~~  
inflammation. Dr. Rush is like Dr. Cullen with  
respect to the formation of Pus, & believes it is not secreted  
but made by fermentation.

Materia Morbifica is not the cause of fever,  
because 1. Fevers are produced, & cured by Passions  
of the mind. 2. Fevers are cured without evacuations;  
3. No sweat & sediment in the Urine is no sign of  
acrimony in the blood; 4. Altering the Mat. Morb. exists  
in the blood, & deny it produces the phenomena  
of fever. Thus it does not depend on Mat. Morb. but  
on storm & unaltered energy of the Sensorium.

Mat. Morb. <sup>fever</sup> is cured by lightning, &  
Electricity, & Terror; & without evacuations  
that are sensible as Bark whose effects  
are more certain, when it increases no  
evacuation. A change is brought in  
the human body twice every 24 hours.  
Every fever has an exacerbation twice every  
24 hours. The proximate cause of fever  
is a spasmodic structure of the extreme  
capillary arteries. The urinary vessels  
of the kidneys are also affected with  
spasm, which is the cause of the  
sediment & cruris in Urine.



Lect. 37. Tumors in fevers, are owing  
to laxity in a particular part. These  
tumors prove that the spasm is solved  
in the capillary vessels, & one part hap-  
pening to be more lax, an effusion takes  
place. Sweat is water, & an Ammonia-  
cal salt. By perspiration a very volatile  
fluid is thrown out, & Phlogiston which  
is proved from the fixed air generated. It  
differs according to the employment  
we are engaged in; the Mat. perspiral.  
is a highly attenuated oil. The Urine  
washes off the saline parts of the blood.  
It has ammon. salt, fine suble  
oil, & but little Phlogiston. The Fac-  
tories in their passage down the ali-  
mentary canal. They contain bile  
gives them the yellow colour; a Vol.  
Alkali, Nit. acid. & Oil. The Saliva  
contains, Water, ammon. salt & viscid  
matter; it is much disposed to form tho-  
my concretions about the teeth. We have  
must found by experiments that Hawks  
somewhat every thing that is indigestible.  
The aliment is comminuted by Mechanical  
force alone in the Turkey, & by the Gastric  
juice alone in the Hawk, & by both in the  
The aliment is only comminuted by the Saliva



Gastric & Mechanical force but always  
undergoes fermentation before it is digested.  
The Saliva assists in digestion; it promotes  
fermentation in the Stomach; it is by no  
means saponaceous as was supposed. The  
Milk is converted into chyle, by fer-  
mentation. The V. & A. fermentation  
always take place in the human stomach.  
The acid is destroyed by the bile with which  
it forms a tertium quid neither acid nor  
bitter. Four parts of Vinegar & five of  
Bile form a tertium quid incapable  
of coagulating milk. The Bile is neither  
saponaceous, putrescent, nor alkaline.  
It is more abundant in quantity, & more  
in quality in Summer than in Winter.  
The Gastric juice is possessed of a very great  
solvent power as proved by its dissolving  
Lead, Iron, & bones equal to the Vit. acid.  
& by experiments made by a Swedish  
Doctor who extracted it by a sponge from  
the stomach of a living dog. It dissolves  
the stomach when deprived of the living  
principle but acts on nothing possessing  
the living principle, as John Hunter found.  
The Bile yields Oil, Water, & Salt.



Milk is a white, opaque, bland liquor  
partaking of both the Animal, & Veget<sup>the</sup> nature.  
It is composed of Oil, Mucilage, & Water.  
The Oil, & Water are Vegetable, & united  
together by the Mucilage which is ani-  
mal. The Oil is the butter, the Mucilage  
the Cheese & the Water forms the Whey.  
By Heat, the volatile parts are vaporated,  
& the Residuum being again vaporated,  
a quantity of Sugar is obtained. Boiling  
Milk evolves its acid, but doesn't render it less  
coagulable. By the escape of its fixed air by  
boiling, it is more coagulable, thus adding  
Wine decomposes it, & makes Wine whey.  
The presence of fixed air seems to retard  
the fermentation. All acids, & the ~~stomach~~  
stomachs of all Animals whether herbi-  
vorous or Carnivorous coagulate Milk. This  
quality of the stomachs is owing to the Gastric  
juice. Dr. of Edinburgh found that  
the stomach of a stung calf (an abortion) coa-  
gulated milk. This proves it is not owing to  
an acid produced by aliment for it had never  
eaten. Alkalies, Neutral Salts & Earths have  
no action on Milk. Rennet is the dried  
stomach of a Calf.



Live Fish. Putrid substances, & the flowers & leaves of Artichoke infused in cold water coagulate Milk; but when infused in hot water they don't. The Oil or cream rises & floats on the surface of Milk. The Pasture changes the Milk. Cows yield the most Milk in May or June.

By Churning Butter is made, occasioned by a separation of the parts of the Milk & of heat are generated by a fermentation sui generis going forward during churning. Butter is more wholesome than Cream, as it don't contain so much Mucilage, on which account it's more soluble. Buttermilk is whey, & a little Mucilage; it's more wholesome than Cream.  $\frac{1}{4}$  of Milk, yet yield  $\frac{3}{4}$  of Cheese. The goodness of the Cheese depends 1. on the Pasture; 2. On the Coagulum we employ; 3. Upon the Milk we use whether skimmed or not; 4 on the manner of preparing it. The superiority of Parmesan is owing to the rich pasture; & of the Gloucester to the Pasture & the using of New Milk with cream & all. Annatto is added to give it it's yellow colour.



New Milk is of difficult solubility. Old is not. The moisture of Cheese makes it liable to putrefy, hence Maggots are produced. Rennet is the most common Coagulum used here. The cheeses made here, are made of Skim Milk, hence their inferiority. The small quantity of Common Salt used in making cheese, hastens its Putrefaction. Old Cheese is used as a Condiment to hasten fermentation. Serum or Whey contains the Sugar or Salt.

3iv. of Ass's Milk yields <sup>9r</sup> 84 of Sugar

Women's	64.
Mares	70.
Cows	54.
Goats	49.
Sheep's	35.

Women's, & Ass's are preferred, tho' in some cases, the Sugar is prejudicial. Milk is used in Consumptions, but if the stomach won't bear it, you may dilute it with  $\frac{1}{3}$  the quantity of Water. An artificial Ass's Milk may be made by adding Loaf Sugar to Cow's Milk.



Both the Herbivorous, & Carnivorous  
Animals yield Milk. Cow's Milk is  
not coagulated by Sp. Fer. Goat's Milk  
resembles Cow's Milk. The sheep's contains  
more Oil, & less whey. Women's Milk is  
not easily coagulated. The Mineral acids  
don't coagulate Milk; it's coagulated in  
a heat of 86 degrees. Sickness don't pro-  
duce any great change in the Milk, since  
Children suck their ~~parents~~ Mothers, in  
diverse disorders with impunity. A Child  
that sucks a Venereal Nurse, can't receive  
the infection without it's mouth is sore.  
Mercury don't alter the Milk as proved  
by it's not changing the colour of silver.  
Saffrons of the kind & spirituous liquors  
produce a great alteration in the Milk.  
The Milk of Nurses in a passion often  
occasions Colic & Diarrhoea. Sp. Liquors  
make it Narcotic, hence the use of Beer.  
& Sp. liquors which don't increase the secretion,  
but make the Milk more narcotic. The Milk  
is acid, or alkaline according as the  
Animal is fed on Vegetable or Animal  
food. It's secreted from the Chyle.



The Milk of Carnivorous Animals is sometimes the best, where the stomach is troubled with acidity, & is very weak. Madder imparts a red colour to the Milk; this is owing to its Oil, which Madder only tinges, hence it colours bones, by its Madder. Milk is the only remedy in Consumptions. It is useful in Chronic Diseases & the convalescent state of acute diseases.

Bonny Clabber is the spontaneous separation of Milk; it is more soluble than Milk. Persons above the age of 45 years should use Milk with great caution. I have seen Dropsies, Strophitis, & Cramps brought on by the use of Milk in Old people. It is proper in Scurvy, all cutaneous eruptions, & to cure Poison. The solubility of Milk is increased by its curdling in the stomach. If a person finds no inconvenience from using Milk, has a good appetite for his Breakfast, & sleeps well you may pronounce him to be healthy, & to have lived temperately. - Goat's Milk is the best for consumptions for this purpose it is used successfully in Scotland. The Sugar in so large a quantity as the milk is of no advantage.



LECT. 38. I believe with Boerhaave  
that the Brain is a Gland, which secretes  
a fluid that is conveyed out by the Nerves,  
its excretory ducts. This fluid does not  
convey impressions. Impressions are con-  
veyed Mechanically, thro' the medium  
of some matter. Bodies are surround-  
ed with a matter, upon which their at-  
traction depends. Electric Bodies, Mag-  
nets, & the sensitive plant are severally  
surrounded with an Ether; in the same  
manner as the Nerves; which collect  
it as electrics do. The medullary fibres  
confer the Ether. 'Tis highly elastic, &  
capable of having its density, & elasticity  
increased or diminished by diseases. 'Tis  
capable of being excited by Cold & Exercise,  
internal impressions of thinking, &  
passions of the mind; for let them be  
removed & the person will fall asleep.  
Thus Sleep is by no means connected  
with an exhaustion or reflection of the  
Nervous Ether. The human body is not



an Automaton as Haller & many others  
have asserted; it stands in need of constant  
stimuli to keep it in action. The state  
of waking is a state of violence to the  
system. A Dutch Physician kept him-  
self to death by taking off all impressions.  
Sleep is brought on by the mind's being in-  
tend on one subject; hence counting, long  
continued sound, as of an Indian War, or of  
Rain dropping on the House, & Grief bring  
on sleep. Sudden transitions of the mind  
from one subject to another, & reflex sen-  
sations prevent sleep; for every new thought  
is a fresh stimulus. There are other causes  
of sleep, as compressions on the brain w.  
by inducing Stomia, produce sleep. The  
absence of impressions is the true cause  
of sleep. These are the remote causes of sleep.  
The relaxation or Stomia of the brain is the  
proximate cause of sleep. The Brain is  
either in a tonic or Stomic state, or in a  
state of Excitement or Collapse. The  
brain is in a tonic state by the con-  
stant action of stimuli, hence waking.  
The abstraction of these impressions produ-  
ces Stomia, hence Sleep: When this is sud-  
denly produced convulsions or startings occur



sleep are brought on. Pleasure produces  
a relaxation of the system; Pain causes  
an increased tone of it. The time of  
sleeping is induced by habit. Night  
is the most favourable time, because  
there is the greatest abstraction of the  
mind as light & Noise. Light is a  
powerful stimulus. Darkening the  
room will induce sleep. The highest  
degree of excitement is in Maniacs. Hence  
their great strength, & capability of en-  
during cold. Exercise in a certain degree  
will diminish this excitement of the  
Nervous Ether. Delirium & Mania are  
each divided into two kinds. Delirium  
ferox, & mite; one from Collapse, & the  
other from excitement. Mania from too  
high a tone, & from too great debility  
& relaxation. Hence the modes of treat-  
ment must be opposite. Delirium or  
Mania from increased tone is cured by  
Bleeding, Evacuants &c. & that from  
debility by Wine, & Tonics. A Person  
near Aberdeen cured Maniacs by plough-  
ing with them, hence the absurdity of  
confining them in cells; they require



fresh air, hard labour, &c. The species of  
Madness in which this treatment is proper,  
is that induced by Love, Study, or unex-  
pected Good fortune. A great genius is  
but one remove from Madness, so near  
are they akin. Sleep is only perfect  
without Dreams. In Persons who dream  
there is a partial excitement or tonic state  
of the brain. This accounts for the Delirium  
in Nervous fevers, & also why hard labour,  
lying on the back, & on soft beds prevents  
Dreams. On the Back the most Muscles  
are relaxed. There are no dreams without  
stimulus. A total abstraction of stimulus  
is necessary to prevent Dreaming. There is  
only a partial collapse in Dreaming.  
Whispering in the Ear awakes a person  
much more effectually than loud sounds,  
& infallibly brings on dreaming or  
Talking. Dr. Beattie tells a story.  
The Mind is as certainly active in  
Dreams as in the waking state. It is the  
height of absurdity to attribute Dreams  
to the volition of an intelligent being.  
They depend entirely on the uncontrolled  
natural association of Ideas; uncontrolled  
by judgement. Imagination & Judgement  
are seated in different parts of the brain, & while  
imagination roves at large in dreams, the judge-  
ment is bridled & confined without acting.



The more incoherent our dreams are, the more complete is the collapse, & vice versa. Dreams occur most frequently, in the Morning, when the body is affected by stimuli as the Urine on the neck of the bladder, & light. The coincidence of our dreams with what comes to pass, is purely accidental & natural; just as diff. thought will intrude upon the Mind in a state of ~~sleep~~ waking, but here the imagination is controlled by judgement, & in sleep it is not. Lightning kills by bringing on an entire collapse of the brain. Death is an entire collapse & loss of sentiment in the brain as in fatal apoplexy.

Dreams & thinking are exactly alike, are natural & mechanic operations of the Mind & body not depending on volition, & without the intervention of the will.



Lect. 39. I shall endeavour to explain  
to you in this lecture, 1<sup>st</sup> What the proper  
Nutritious fluid is; 2<sup>nd</sup> Its formation or  
secretion; 3. In what manner it is conveyed  
to the different parts of the body. The coa-  
gulable lymph is what nourishes the body.  
It is altered, & secreted from the blood by the  
Cortical part of the Brain; & then con-  
veyed to every part of the body, by the  
nerves, the excretories of the brain, which  
is the principle, & seat of life, the first  
that is formed & lives & the last that dies.  
It is proved to be a gland & to secrete a  
fluid from the large quantity of blood  
sent there. Every part of our system  
was originally fibrous, & was formed of  
& from the Nerves, which are of a fibrous  
texture. In Plants, the nerves convey  
the nutritious fluid, & why not do the  
same in Animals. The juice conveyed  
by the nerves is too gross to convey im-  
pressions to the brain & perform motion.  
The size of the liver & lungs which are  
offered as objections to this theory, by Dr  
Haller, depends on the quantity of fluid  
circulating in them.



The brain secretes an instinctive fluid from the coagulable lymph, which is propelled through the nerves by an energy from the brain. The latter assists in this propulsion. The latter in plants being in Motion propels the nutritious fluid. The nutritious matter must be a secreted fluid, therefore the Blood vessels can't convey nutriment for they don't terminate in Glands but in vesicles or capillary tubes. A nerve is always accompanied with an Artery which mutually assist each other. When there is sensibility, there must be blood vessels. The tension of the Blood vessels increases the tension, sensibility, & irritability of the nerves. The uses of the Blood are, 1. To distribute heat over the system, 2. To carry humidity over the system, 3. To produce Tone in the nervous system, a certain degree of tone is necessary for sensation, this is evident in inflammation of the eye the sensibility being increased. 4. To convey a fluid to those parts, from which



secret fluids are obtained. Hence we conclude  
that sense & motion don't depend on the  
nerves but on a matter called Ether. 16  
or 20 Medicines are sufficient to cure all the  
Diseases within our reach. Simplicity should  
be particularly attended to in our prescriptions  
because all powerful medicines act best in  
a simple state; & when mixed are apt to  
decompose each other; they sometimes counter-  
act each other & form a testimony given that will  
prove either dangerous or totally inert. In com-  
pound Medicines, the strongest only will  
act; two impressions can't be conveyed at the  
same time; thus if two bodies impinge on a  
third, they drive it in the direction of neither  
but in a diagonal of both; & if two diff.  
ideas strike a person's mind at the same time  
neither of them will be remembered, but a third  
is formed totally different from both. The  
Rheumatism that Congressed Bark & Valerian  
given separately, was cured by them given mixed.  
Opium is rendered inactive by acids & given after  
them; as acids & bitters destroy each other. A  
Dropsy which resisted Oxy-mel Scillitum for  
a long time when it became Latitum, was  
cured by leaving it off & taking Oxy-mel edulcorum  
& then recurring to Oxy-mel Scillitum again. When  
a disorder has been long treated by bark, it is very neces-  
sary to try Gentian, Cinchona, &c. & then giving bark again.  
One Medicine should be given at a time, & the weakest  
always begun with & go gradually to the strongest.



The Medicines should be sometimes sweet & palatable. Respiration is the means by which the body is supplied with heat. Heat is occasioned by the principle of inflammation evolved from the blood by the lungs, this may be the cause of Respiration. The Lungs appear to be the fire place of the system. The generation of heat in the human body is analogous to the production of heat in a culinary fire; by the mixture of the principle of inflammation with vital air. The separation of the principle of inflammation is occasioned by the accession of Vital air, therefore the greater the quantity of Vital air, the greater the heat; hence the great heat in fevers, & in great exercise. The degrees of excitement are various; thus 1<sup>st</sup> in Maniacs there is the highest degree of excitement; 2<sup>nd</sup> the next degree of excitement is in ordinary health; 3<sup>rd</sup> the next degree is in sleep; 4<sup>th</sup> the next degree is in Syncope; & 5<sup>th</sup> the lowest degree is in Death. Lightning destroys people this way, i.e. by the violent excitement it destroys the powers of the Brain.



## Fourcroy's Chemistry.

Art. 2. VIZ Affinity of Aggregation & Affinity  
of Composition Aggregations 1. VIZ Solid  
Soft. Fluid & Aeriform. The Affinity of Compo-  
sition is in the inverse ratio of that of Aggrega-  
tion. it takes place between bodies in the point  
of contact only. It prevails only among bodies of  
a different Nature. Between small bodies only  
Among not more than four with an Equal  
affinity. It is necessary that one of two bodies  
united by affinity of Composition be fluid  
The properties are different afterwards. The  
temperature changes in the very action  
All the Operations of Chemistry are reduced  
to two VIZ Analysis & Synthesis. prin-  
ciples are immediate & remote. The former  
the component or Secondary parts of bodies  
& the latter their Elementary or primitive  
parts. Natural bodies are divided into three  
Kingdoms VIZ Mineral Vegetable &  
Animal. The Mineral Comprehend all  
the hard inorganic bodies which form  
the Mass of our Globe. The Vegetable are



formed of fibres & Vessels which contain  
fluids. Their functions are generation.  
Digestion. Nutrition, & Secretion. The  
Animals are characterized by circulation  
Respiration. Irritability. Sensibility  
& loco-motive power. The Elementary  
Water. Air. Fire & Earth. The Effects  
of Fire are three viz Light. Heat &  
Rarefaction. Light is elastic & has  
weight. The former is proved by the  
angle of incidence being equal to the  
angle of Reflection — The latter by the  
Refraction it suffers passing by the  
side of a body. Heat dilates minerals &  
contracts organic bodies. M<sup>r</sup>. Schuele says  
Heat is a Combination of Phlogiston with  
pure or empirical Air. Light contains  
Phlogiston in a state capable of Separation  
If a solution of Silver in Nitrous Acid  
be poured on Chalk & exposed to sun-  
-shine the metallic calx revives by  
attracting phlogiston from the rays of  
Light. Pure empirical or De-phlogisticated



Air is the only Subulum to and has the  
strongest affinity with Phlogiston of any  
other Substance. M<sup>r</sup>. Lavoisier says every  
calx is heavier than the Metal from  
which it was produced. Therefore a loss  
of Air is observable which is the Pure  
portion of the Air that goes into the calx  
or into the remains of the combustible  
body. Pure empirical Air is the only  
combustible body. D<sup>r</sup>. Crawford says  
Phlogiston & Heat are two distinct substan-  
ces whose presence in the same body at  
one time is quite incompatible & that  
whenever the one enters the other is  
expelled. The Metal parts with its  
Phlogiston to the Air which returns  
Heat to the calx. All inflammable  
bodies contain a large quantity of Phlogis-  
ton in their composition which is there  
but loosely. Dephlogisticated Air contains  
absolute Heat & has a strong Attraction for  
Phlogiston. The Diamond is the most  
combustible body known since it leaves  
no Residuum. Atmospheric air is composed



of three fourths of mephitic gas & one fourth  
of pure Air. Combustion is the Com-  
bination of pure Air with the combusti-  
ble bodies. The Air may be reduced to  
128<sup>th</sup> of its bulk. The Air remaining  
after combustion which is improper  
for every thing that Atmospheric  
Air is, is called mephitic or Phlogistic  
gas. What characterises Air is its favouring  
Combustion & supporting animal Life  
by serving for respiration. Dephlogisticated  
Air which is one fourth of the Atmosphere  
is the only useful part of the Air. It  
eminently favours combustion & serves for  
respiration. Fixed Air or Aerial Acid  
Destroys Animals extinguishes flames &  
prevents the calcination of metals  
Its effects resembles those of the Common  
Acid. It is specifically heavier than  
Common Air. Its presence enables  
water to Dissolve Metals & earths. The  
impregnation gives an Acid taste to



Water. The sparkling appearance of Liquors  
of mineral waters is owing to its presence  
Phlogisticated or inflammable air is  
very light ten times lighter than com-  
mon Air. It turns only when in  
Contact with empyreal or De-phlogistic Air  
Heptatic Air is produced from mixture  
of Sulphur with Different Substances  
by the Effusion of the mineral Acids  
It extinguishes fire. precipitates lime  
water & is absorbed by water it gives a  
Heptatic Smell & Rousish Taste to the water.

The other kinds of Air are Nitrous.  
Marine & Vitrolic Acid Air & Alkaline  
Air. Water is Elastic Its Natural State  
is Ice. Heat of some Degrees is produced  
in the water that freezes. The Recess of the Air  
& Slight Motion Accelerate this formation  
The Elasticity of Ice is greater than that of  
water. The heavier the Air the more time &  
Heat are required for boiling a fluid. Boiling  
& agitation favours the Separation of Gas



Science & Other Heterogeneous Substances  
Earths are Divided into Vitreous  
Quartz & Argillaceous. The first is not  
Altered by fire the second is deprived  
of its transparency & reduced into a  
white & friable Earth they are both  
capable of Fusion & Vitrification. The  
Argillaceous unites with the Acids  
and with them forms particular  
Salts 1. Simple Earthy Stones  
which are insipid. Dry. hard. insoluble  
in water are divided into four Orders  
Viz. Vitreous Stones, Quartz Stones,  
Argillaceous Earths & Stones, False Clays.  
2. Compound Earthy Stones Viz  
Obsidian, Tealite, Crystal, Lapis Lazuli  
Volcanic products 3. Mixed Earthy Stones  
Viz Flint & Rock Stone, Granate Porphyry,  
Opal & Opalite The Second Class of Minerals  
is Saline Substances. They are Charac-  
terized by taste Solubility in Water  
tendency to combination & respect



incombustibility. They are Divided into  
Primitive & Secondary compound or  
Neutral Salts. The Genera of the first  
are three viz 1<sup>st</sup> Saline Earthy Substan<sup>ces</sup>  
2<sup>nd</sup> Alkalies 3<sup>rd</sup> Acids. Species of the first  
are 1<sup>st</sup> Terra Ponderosa 2<sup>nd</sup> Magnesia  
3<sup>rd</sup> Quicksilver all Alkalies Species of  
the Second are 1<sup>st</sup> Vegetable 2<sup>nd</sup> Mineral  
3<sup>rd</sup> Volatile Alkalies Species of the  
last are 1<sup>st</sup> Chalky Acid or fixed Air 2<sup>nd</sup>  
Marine 3<sup>rd</sup> Sparry 4<sup>th</sup> Vitrous Acid  
5<sup>th</sup> Aqua Regia 6<sup>th</sup> Vitriolic Acid fluid  
of Borax. 3<sup>rd</sup> Class Combustible  
Substances viz 1<sup>st</sup> Sulphur 2<sup>nd</sup> In-  
flammable Gas 3<sup>rd</sup> Diamond.

### Metal. Iron.

Iron is an imperfect metal. Lighter than all other metallic sub-  
stances except Tin. A thread of Iron 10 inch diameter supports 4500 lb.  
without breaking. Iron partakes of all the properties common to other  
metallic substances & has three peculiar to itself viz 1<sup>st</sup> Magnetism  
2<sup>nd</sup> Casing suddenly by stroke of flint, & the only metallic substance  
found in Plants & Animals whose humors are partly coloured  
by it. Plants raised in pure water contain it, which may be  
extracted from their Ashes. The Iron Ores are 11 viz 1<sup>st</sup> Native



Iron; it's very rare. In Saxony, Siberia & Senegal. 2 Bog  
Iron Ore or Iron in rust or calcined. It's found copiously  
in Organic substances. Organized substances are often  
changed into Iron & in another metal. 3 Chites or Eagle  
Stone is a variety of Bog Iron. 4. Hematites a kind of Bog Iron.  
5. Magnets a kind of Bog Ore of Iron. 6 Emerald or Smirveline  
powder it's used for the polishing of Glass & Metals. 7 Mart  
Iron, a calx of Iron combined with chalybeate & carried  
along by water. 8 Martial Vitriol or green Copperas. Iron  
in a saline state united with the Vit. Acid. Calcined to  
a great degree it's called Colcothar. 9 Pyrites Iron & Sulphur.  
The upper stratum of Coal pits. They form Mart. Vit. 10.  
Iron combined with Arsenic called Spuma Lupi. 11.  
Black Iron is quite soluble in the Acids & is attracted  
by the Magnet. Iron crystallizes in Polygons. Crocus  
Martis. Strengens is Steel filings reduced to a calx  
under a Muffle. It isn't attracted by the Magnet. Crocus  
Martis aserens is the rust of Steel filings exposed to air.  
& moisture with water; a combination of Iron & chalybeate  
Water has a great action upon Iron. It's soluble in all  
acids. Neither water nor Iron separately is able to decom-  
pose Sulphur, but both conjointly do. The Iron seizes upon  
the Phlogiston of the Sulphur & the acid of Sulphur  
unites with the water & dissolves the metal. Oil of Vit.  
is formed by a combination of the Sulph. with pure  
or Deph. air. The precipitate of Mart. Vit. decomposed by  
an Alkali calcined with Ox blood is called Prussian  
Blue. Phlogisticated Alkali is a mixture of an equal  
quantity of Nitre fixed by Tartar & Ox blood mixed  
together & calcined in a crucible till flame ceases to issue.  
It then dissolved in water. This is concentrated by



evaporation precipitates Prussian Blue from a solution  
of Prussian Blue & Alum. Martial Vit. very easily  
& rapidly decomposes Nitre. The solution of Alkali  
by the action of Kali is called Ro. Mart. Alk. Stahl.  
Marine Acid dissolves Iron with rapidity, & sends  
off a great quantity of inflammable gas. Sal. Ammon.  
is decomposed by Iron, the sublimed matter of this is the  
Ros. Mart. Sal. Ammon. over Ros. Mart. Neither Mercury  
nor Lead contracts a union with Iron. Zinc is indubitably  
Plumbago is a species of Sulphur composed of 1/2 Aerial  
Acid, & 1/2 Phlogiston. It is an intermedium between  
Forged & cast Iron. Crucible Iron is left rich in Δ Iron  
when Plumbago: forged Iron vice versa. The decomposition  
of Plumbago the expulsion of 1/2 aerial Acid, & the expe-  
lusion of 1/2 Phlogiston to the impoverished metal changes  
crucible Iron into malleable Iron. Iron & Bismuth alone  
stand by fixing.

### Copper.

Copper is an imperfect metal. From the Pyrites of copper  
washed, aired, vitricated, washed, & the ley filtrated, is ob-  
tained by evaporation & crystallization a blue salt called  
blue Vit. Water does not appear to attack Copper, unless  
converted into vapour. Caustic fixed & volatile alkali dissolves  
Copper rapidly. The Nit. acid alone attacks & dissolves Copper  
cold. Copper decomposes Alum & Sal. Ammon. similar,  
Pinchbeck, Prince Rupert's metal, & Manheim Gold, are  
varieties of copper combined with Zinc. Brass is a combina-  
tion of Copper with Lap. Calamin. The specific gravity of



a mixed metal frequently exceeds that of the heaviest of  $\text{Fe}$ ,  
as a mixture of  $\text{Fe}$  &  $\text{Cu}$ . The specific gravity of the tin  
exceeds that the mean gravity of  $\text{Fe}$  two metals & even that  
of the heaviest of them, & vice versa sometimes the same but  
seldom. The perfect metals are three viz. Platinum, Gold, & Silver.  
Martial Ethiops is made by precipitating a Nitrous Solution  
of Iron by the caustic  $\text{Alk}$ . alkali & washing & drying.  
The precipitate quickly. Liver of Sulphur. completely dissolves  
Gold. Silver unites with Arsenic. Aqua regia acts very well  
upon Silver which precipitates as the solution goes on.  
Silver is unalterable by the neutral Salts. It mottles  
The combustible matters act more or less on silver. They  
diminish its ductility & turn it quickly of a violet or blue colour  
as Animal hepatic vapours as of Pruric, Putrid Urine, warm  
eggs &c. Nit. acid is rapidly decomposed by Iron. Aqua regia com-  
posed of  $\text{H.}$  & of Nit. & Marine acid. dissolves Platinum best.  
Lime & the pure Alkalies unite with the Bitumens &  
form Soap. They originate from the Oils & Fats of Marine  
Animals chiefly, & the resins of vegetables. Amber is  
hardened & impregnated with mineral & saline vapours.  
Succin. has all the characters of an oily vegetable acid. Ess. de  
Succ. is a soap made of the essent. Oil of Amber united with  $\text{Alk}$ .  
volatile caustic alkali. Jet is Asphaltum made hard  
by the lapse of time. Fossil Coal is found in the Heart  
of the Earth, in horizontal or inclined layers below the  
mineral or Pyritous Masses. Pet coal is distinguished into Earth  
& ~~stone~~ coal. Ambergise is a concrete substance of a soft  
& tenacious consistence like wax. It is found in the Mo-  
narch of Wales. The English Coals is the charred residuum of  
Pet coal after combustion. Rust of Iron should be called Brita  
Martialis. The solution of Iron in water charged with  $\text{H}$



Serical acid turns Syr. Viol. green & gives Prussian Blue with the Phlogisticated alkali. Lime water digested with Prussian blue, dissolves the colouring matter by means of a little heat very rapidly. It is coloured & the blue assumes the colour of rust. It is evidently neutralized by the colouring matter & has none of the signs of an alkali. The ppt. of yink is united with a principle in the Gall nut disseng. it from the acid. It is in an oily state. This precipitation does not appear in an acid solution, & disappears by the addition of an acid. The Iron is precipitated here, because the astringent principle has more affinity with the Vit. acid, than the Metal has.

Vegetables are organized substances, with motion or sensibility. They differ from Minerals in being nourished by incrustation. They differ from Minerals in being nourished by incrustation, & because they prepare the juices distinct for the increase of their bulk. From M. Ingenhousz's experiments, it appears that leaves absorb Phlogisticated by their inferior surface, & emit dephlog. air by their superior when exposed to the Sun. The different ~~parts~~ modifications of the Sap into Saccharine, Oily, Mucilaginous fluid correspond exactly to the glandular secretions of Animals. M. Lavoisier has described glands of several diff. forms in Plants at the base of leaves, & the extremity of the Petals of certain flowers. The odorous spirit of vegetables forms round them an atmosphere sensible to our organs, & sometimes inflammable by the contact of a burning body as the Traxinella, being an inflammable Gas sui generis. The Walnut & few Trees & several others of the hot countries emit vapours mortal to animals exposed to their action. Parkne changes the property of the leaves which give only a pure air when deprived of the contact of light. Vegetables absorb the gaseous residue of combustion & respiration.



since vegetation becomes more rapid & strong in air altered  
by these Phenomena. Stamina of the *Plantula Varietaria*.  
Plants raised in darkness are white, insipid, aqueous,  
& contain nothing inflammable; & vice versa. The rays  
of the sun colour in Plants their colour, taste, & combustible  
property. The humors of vegetables are two viz. common, &  
proper. The sap is not an aqueous fluid it contains Salts,  
Extracts, & Mucilages. They are purified by 1. Repose, 2. White  
of an egg, 3. Simple heat, 4. Filtration, 5. Sp. Vin. 6. Vegetable  
acids, as with the Cruciform Plants. Extracts are divided  
into Mucous, Sappy, & Extracto-resinous. The first dissolve  
in water & pass to the Sp. Vermen. The Sappy are dissolved  
in water partly in Sp. Vin. they grow mouldy rather than  
pass to the Sp. Vermen. The Extracto-resinous dissolve in  
water, & Sp. Vin. and Terra Japonica is extracted from the  
infusion of the seed of a kind of Palm. Extracts are resinous  
extractive or extracto-resinous according as one or the other prevails.  
Essential Salts of Plants is a name given to the saline  
substances dissolved in their juices or by the water of their infusion.  
They are purified by pure argilla & Whites of eggs. The classes  
are two viz. 1. Those resembling the mineral salts, the principal  
kinds are 1. The mild fixed alkali got from almost all plants  
by maceration in acids. The Mineral is found in the Marine  
Plants. 2. Tart. Vit. from Millefol. Borrag. Styringonta, Stro-  
matis &c. 3. Sal. Glaub. from Tamarisk. 4. Nitre from Turned,  
Tobacco & Borrag. 5. Sal. feb. Sylv. from Marine Plants. 6  
Selenite from Rhubarb. Cruciform Plants yield vol. alkali  
on the first impression of heat. 2. Those particular to vegetables  
always formed of an acid united with an alkali & an Oil.  
They are distinguished into acid & sweet. The former are in



Sorrel & the acid fruits. The essential acid salt of Sorrel M.  
Bergman says is a vegetable alkali supersaturated with  
a particular acid. Acid of Sorrel decomposes Selenite. It pre-  
fers Lime to the Alkalies. The Sparry, Phosphoric, Arsenical,  
Borax, Sugar, Tartar, Sorrel, & Citron's acids when combined  
with Earths are almost insoluble, & are soluble by an ex-  
cess of acid only. This property is not found in other acids.  
However Selenite, & heavy Spar, & earthy salts formed by the  
Vit. acid have almost no solubility. 2. Essential Saccharine  
Salts are found in Maple Birch, But, Cassia &c. The *Arundo*  
*Saccharifera* has the most of it. Salt of Sorrel crystallizes.  
The acid of Sugar carries off its base of Lime from all other acids.  
It dissolves clay the base of Alum. It yields a vast quantity  
of aerial acid & inflammable gas. It combines with the  
Metallic calces more easily than with the Metals. Pure or  
Deph. air combined with Nitrous gas constitutes the Ni-  
trous acid. Manna is obtained from the Ash tree in Ca-  
labria & Sicily. It flows naturally, & by incisions in the  
bark. It gives to distillation the same as Sugar. GUMS  
or Mucilages burn without flame, are insipid & give to  
distillation a great quantity of acid Phlegm, a little em-  
pyreumatic oil & some volatile alkali. The coal which  
is very bulky contains vegetable alkali. Oils are proper  
juices fluid or solid insoluble in water combustible with  
flame. They are distinguished into fat, & essential,  
fluid, & concrete. Fat oils are chiefly with taste or smell.  
They require more heat than that of boiling water to co-  
distillize them. They are obtained by expression. They give  
to distillation an acid phlegm of pungent odour light oil,  
thick oil & a great q<sup>ty</sup> of inflammable gas mixed with



aerial acid; a little charcoal remains. Water purifies fat  
Oil by taking away their mucilage, to whose fermenting  
property they owe their rancidity. Heat drives off the  
Oil, & volatile alkali arising from the decomposition of fixed al-  
kali & Oil. The coal contains fixed alkali. The Vol. & Volatous  
acids combine rapidly with fat oil, & form a kind of soaps.  
Lime & Magnesia unite with fat oils & form insoluble  
soaps. They dissolve metallic calces but no metal except P.  
which is chemically dissolved in Merc. ointment. It is ca-  
sily decomposed by other which precipitates the mercury.  
Essential Oils are got by expression from Bergamot,  
Citrons, Oranges &c. & by distillation. Exposed to the air,  
they grow thick like Resin. Camphor is a concrete, & a crys-  
talline substance. It is very volatile. Concentrated acids  
dissolve it. The fat & essential oils dissolve it with heat.  
Sp. Vin. Camph. is excellent in & cures gangrenes.  
Boerhaave calls the Spiritus Rectorij odoriferous principles.  
Sp. Rectorij & Essential Oil are inseparable. It is a gas  
sui generis. Essential & Distilled waters are solutions of  
the Sp. Rectorij. Balsams, & Resins are inflammable juices.  
Balsams differ from Resins in having a sweet smell & com-  
municating it to water & in containing odorous acid salts  
which may be obtained concrete by sublimation or decoction  
in water. There are three viz. Benzoin, Balsam of Tolu,  
Pere, Cartagena; Storax; Resins are Balsam of Mysore,  
Copaiba. The turpentine, Pitch, Resin of the Pine, Tacea-  
matacca, Mastich, Sandarac, Guaiac, Labdanum, Sarg-  
Dragon. Gum-Resins flow by incision from trees or  
plants. They are Resin & extractive matter. They are only  
partially dissolved by Water, Sp. Vin, Vin. Rect.



They are Libanum, Galbanum, Scammone, Gamboge,  
Spagelia, Rhus Sultana, Hepatic, & Caball, all of the  
same leaves only in different degrees of Purity; Myrrh,  
same leaves only in different degrees of Purity; Myrrh,  
Immonne. Cacao-hau is dissolved by Nitrous & other  
Oils. Camphor & the fat oils & wax by heat. Tracula is a  
substance obtained by reducing in a mortar, a root, stem,  
leaf, or any such into a pulp. The deposition of the fluid ex-  
pressed from the pulp, & left to precipitate is the Tracula  
insoluble in cold water. Tracula of Bryony, Pommelle  
terre, Caspava, Sago, Salep, & Starch are chiefly used.  
Sago is prepared from the sweet marrow of a kind of  
Palm growing in the Moluccas. Salep is the root of a  
kind of Orchid growing in the East Indies. Farina  
resides in the graminous seeds particularly Wheat, Rye,  
Oats, Rice, Indian corn &c. & in the Leguminous seeds.  
Wheat contains a vegeto animal or glutinous part,  
Starch & a mucous saccharine part. This last causes  
the particular fermentation in Wheat. Starch is the  
most copious part of the Farina. The glutinous part ex-  
posed to naked fire exhibits all the marks of an ani-  
mal substance. It yields to distillation the same that  
animals do, viz. Alkaline Spirit, concrete volatile alkali,  
& an empyreumatic oil; its coal gives no fixed alkali.  
It is abundantly more copious in Wheat than in the other  
Farinas. The following colours are resinous, insoluble in  
water & Sp. Vini, but soluble in the Alkalis viz. Annatto,  
Barbare Saffron, Archil, Indigo, & Alkanet which  
gives its colour to Oil, Tartar Ashes, or Soda.



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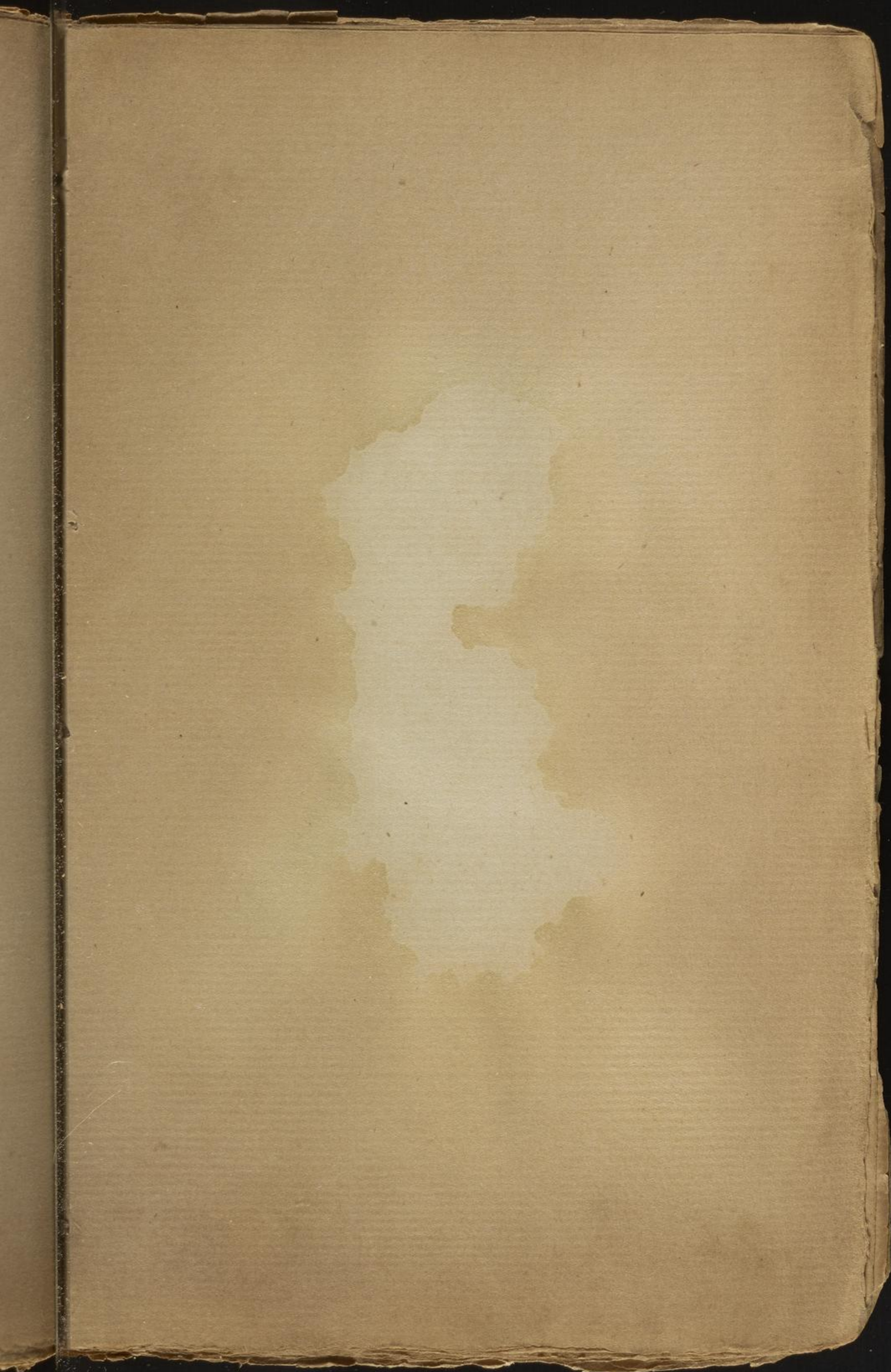
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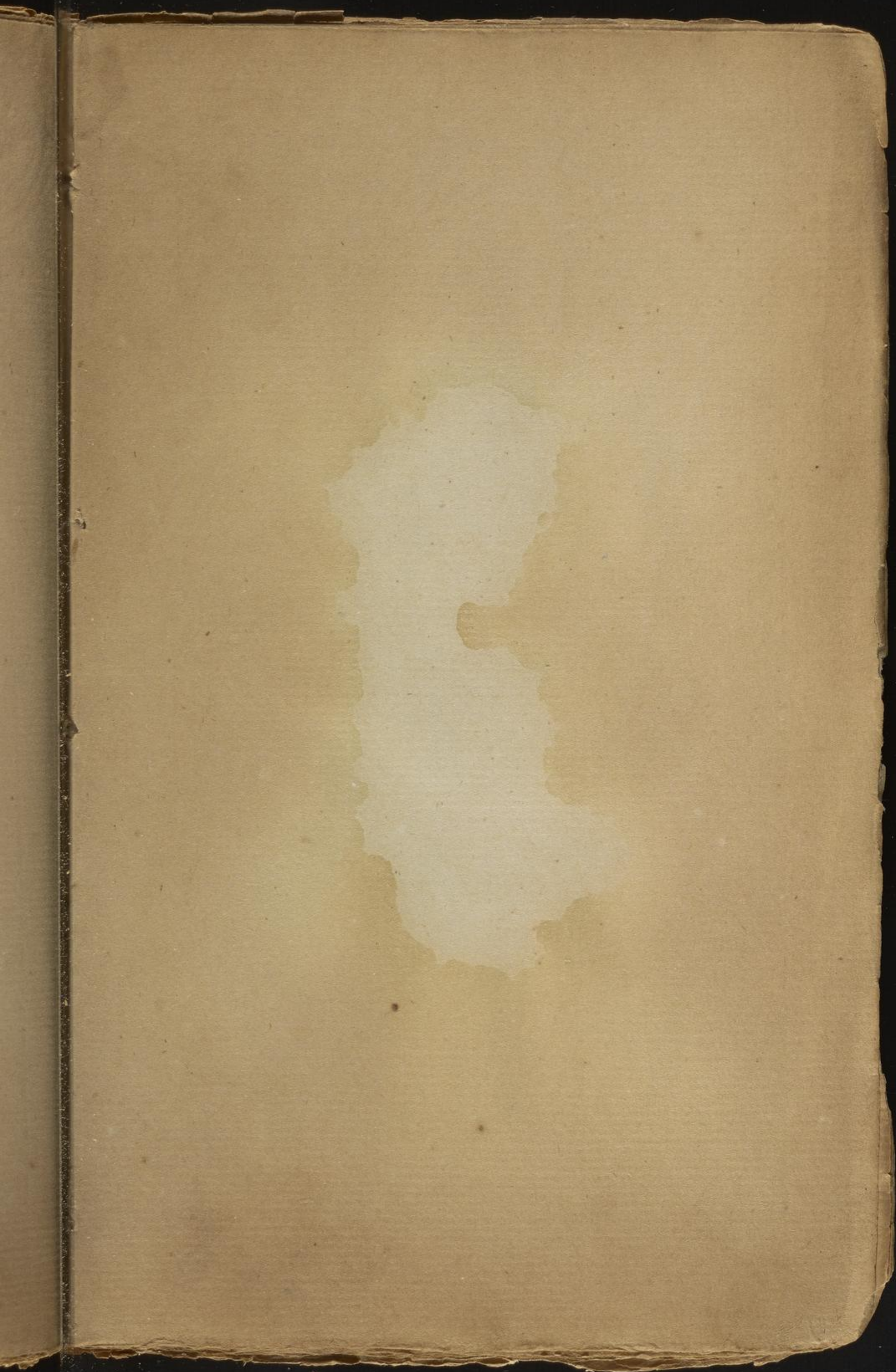
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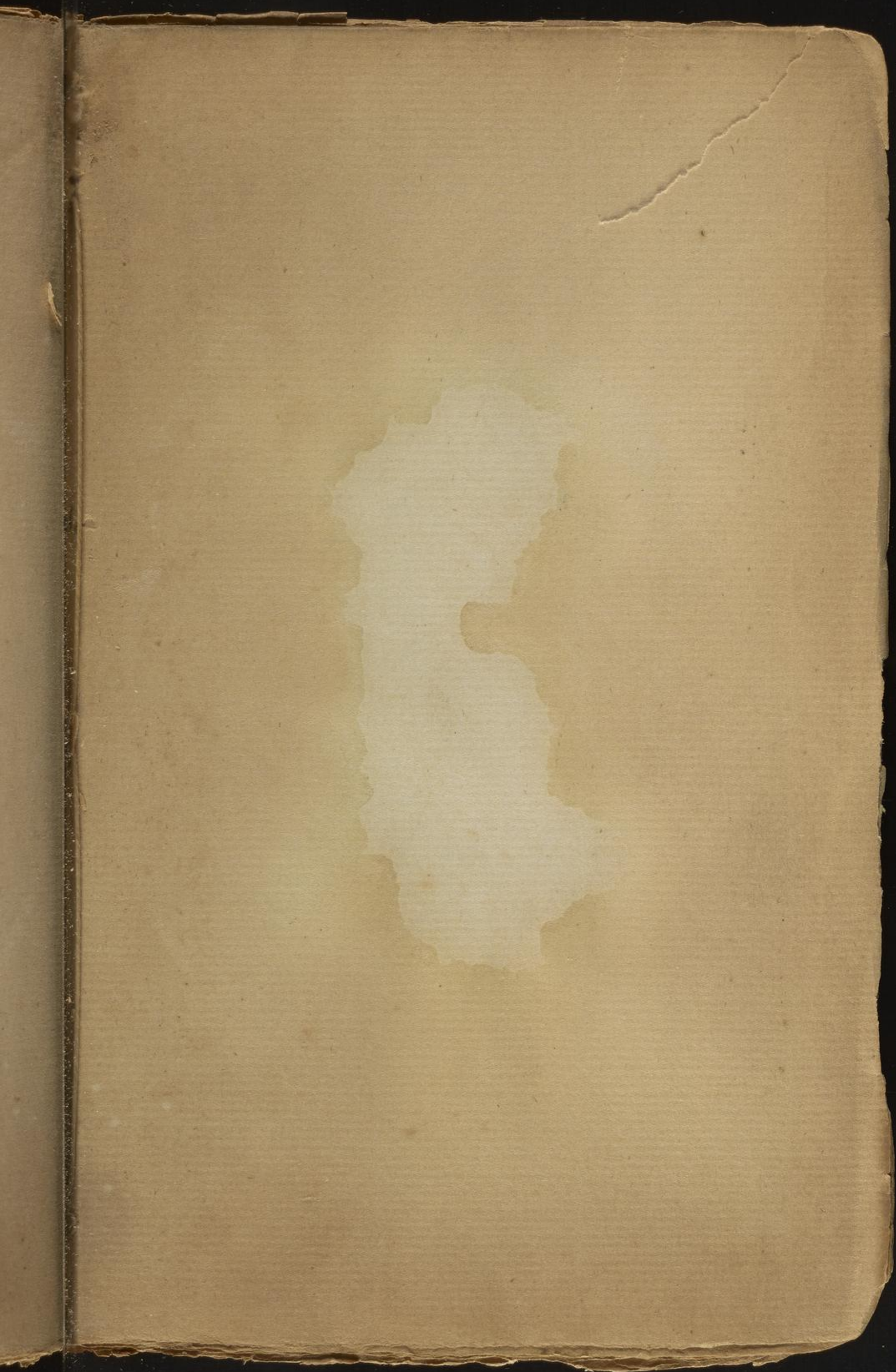
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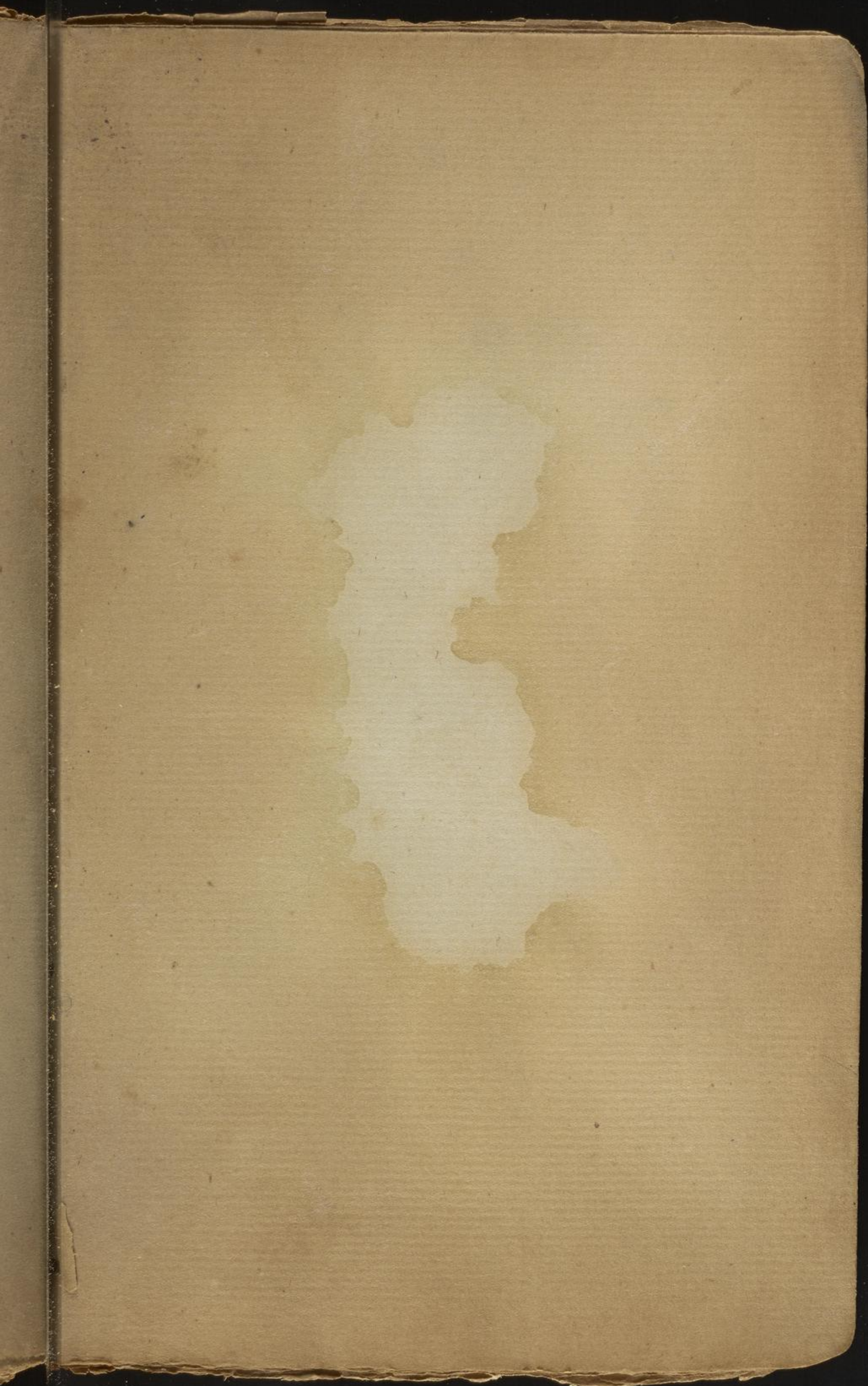




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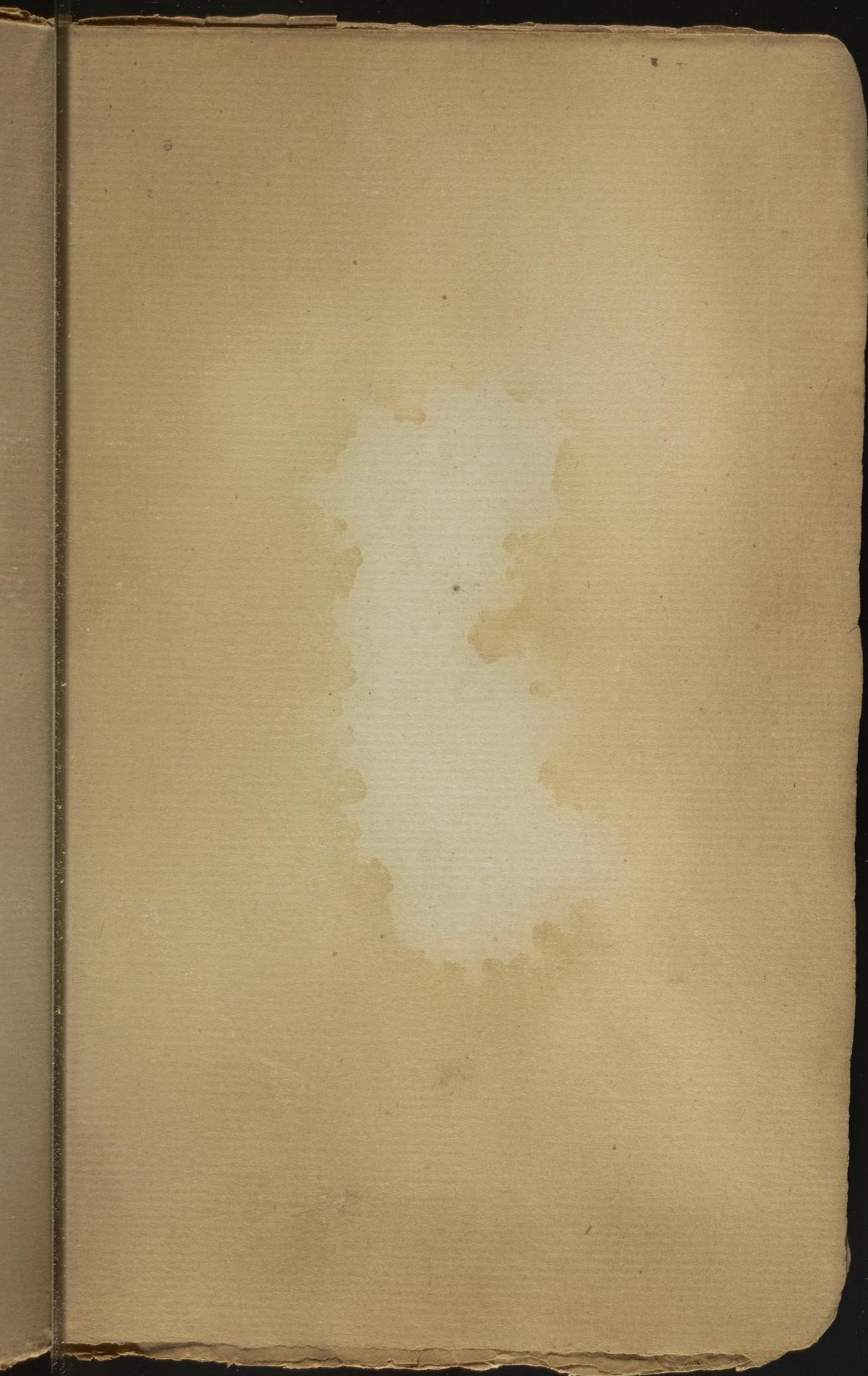














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# 1 Vitriolic Acid.

Phlogiston - - Sulphur.  
Fixed Alkali - - Tart. Vitriolat.  
Volatile Alkali - - Sal. Ammon. Vitriol.  
Magnesia - - Sal. Cathart. amar.  
Lime - - Vitriol. alb.  
Iron - - - - - vivid.  
Copper - - - - - corol.  
Water - - - - - Sp. Vitriol.

# 2. Vitreous Acid.

Phlogiston - - Vitreous Air  
Fixed Alkali - - Vitre.  
Volatile Alkali - - Sal. Amm. vit.  
Iron  
Copper  
Silver - - - - - Caust. Lunat.  
Water - - - - - Sp. Vit.



3. Marine Acid.

Fixed Veget. Alkali - - Common Salt

# Calcareous Earth - - Liquid Shell  
or  
Sal. Ammon. fix

Volatile Alkali - - Sal. Ammon.

# Fixed Veget. Alkali - - Sal. Digest.

Regulus of Antimony - Butter of Antimony.

Silver - - Luna Cornea.

Mercury - - Merc. corros. sub.

Lead - - Plumb. corneum.

Water - - Lye of Salt.

4. Vitrous Acid.

Fixed Veget. Alkal. Ferri. solub.

Volatile Alkali Sp. Mineral.

Magnesia

Lead - - Sacch. Saturn.

Copper - - Chrysol. Miner.

Water - Vinegar.



Water.

Part of sun.

5. Fixed Vegetable Alkali.  
 Vitriolic Acid. - Part. Vitriol.  
 Vitriolic Acid. - Vitric.  
 Marine Acid. - Sal. Digest.  
 Acetous Acid. - Part. Rectification.  
 Fixed Air. - Mild Fixed Alkali.

7. Volatile Alkali

Vitriolic Acid. - Sal. Common. Vitriol.  
 Acetous Acid. - Vitric.  
 Marine Acid. - Common.  
 Veget. Acid. - Veget.  
 Fixed Air. - Mild Volatile Alkali.

6. Fixed Vegetable Alkali.  
 Vitriolic Acid. - Sal. L. Sub.  
 Vitriolic Acid. - Vitric. Cubic.  
 Marine Acid. - Common Sal.  
 Veget. Acid. - Acetous Sal.  
 Fixed Air. - Mild Vegetable Alkali.



C. Calcareous Earth

Vitriolic Acid - Seleniums Vit.

Nitrous Acid - — Vit.

Marine Acid - Liquid Shell.

Veget. acid

Fixed Vit - Lime

Water - Lime Water.

10. Metals

Marine Acid

Vitriolic —

Nitrous —

Antimon

9. Earth of Magnesia

Vitriolic Acid - — Chrom. Salt.

Nitrous —

Marine —

Vegetable —

Fixed air - — Magnesia.

11 Phlogiston

Nit. Phlogisticated air

Vitriolic acid - — Sulphur

Phosphoric acid - — Phosphorus.

Metallic Calces - Metals.

White Animal Earth - — Coal.

12. Sulphur

13. P. — — — —



Alloys —  
Metallic Calces —  
Metals —  
Metals —  
Metals —

12. Sulphur

Fixed Alkali: Hepar. Sulph.

Absorb. Earth

Vol. Alkali

Iron

Reg. of Antim. Antimony.

Mercury — Cinnabar

13. Fixed Oil

Terra Pondrosa

Calcareous Earth — Chalk, Lime.

Fixed Oil of Alkali

Earth of Magnesia — Magnesia

Fixed Oil of Alkali — Fixed Oil of Alkali

Volatile Alkali — Mild Potash Alkali.

Alloys —  
Metallic Calces —  
Metals —  
Metals —  
Metals —

14. Pure Oil

Phlogiston — Phlog. aer.

Fire

13. Spirit of Wine

Water: Spirit. Vin. Fer.

Essential Oils — Essences.

14. Water

Spirit. Vin.

Vol. Alkali: Spirit. Sal. Ammon.

16. Pure Oil

Phlogiston — Phlog. aer.

Fire



From Kirwan's Mineralogy.

There are 17 Metallic substances, Gold, Silver, Platina, Copper, Iron, Lead, Tin, Mercury, Zinc, Regulus of Antimony, Regulus of Arsenic, Bismuth, Cobalt, Nickel, Regulus of Manganese, Selenites, & Reg. Molybdena. These are all soluble in the Nit. acid or  $\text{H}_2\text{SO}_4$  reg. & all precipitated in some degree by the caustic alkalis. Except Platina by the Prussian Alkali. Plumbago is used for Pencils. It is too soft to strike fire with steel. It is insoluble in the mineral acids, & contains twice as much Oxygen as charcoal does. It is wholly volatile in a strong heat, & open fire, leaving only a little iron which is accidental, & a few grains of Silica. Platina is distinguished from all other Metals by being precipitated from its solution by Sal. Ammon. It is soluble only in  $\text{H}_2\text{SO}_4$  reg. or dephlogisticated Marine acid. Cobalt is very hard, brittle, & steel grain of a bluish grey colour. Its specific gravity is 7.700. its fusibility is that of copper. It can be melted with Borax, or Potash & white siliceous sand, gives a blue glass. The reg. is easily soluble in  $\text{H}_2\text{SO}_4$  Nit. or  $\text{H}_2\text{SO}_4$  reg. difficultly in the Nit. acid, & scarcely in the Marine acid. The calx is more easily dissolved by these acids, it yellows even to the acetous. Nickel is a reddish, white semi-metal, of great hardness. It is always magnetic. When pure it is in some degree malleable. Its fusibility is nearly as that of Copper. It is difficultly in the Nit. or Marine acid, but easily in the Nitrous



These solutions are green but Vol. & Alkalis  
turns them blue. Iron discovers no colour in  
them. Reg. Manganese is of a dusky white  
colour. When pulverised it is always magnetic,  
but in larger pieces it is not so; exposed to the  
air in moist weather, it soon crumbles into  
a blackish brown powder. It is soluble in acids  
but most readily in the Nitrous. It loses the  
proportion of Phlogiston necessary to its  
metallic form more readily than any other  
metallic substance. Manganese seems to  
be contained in the rinds of most vegetables,  
& to it the bluish or greenish colour of calcined  
vegetable alkali is owing. It is principally  
found in cast Iron, & the ores of cold short Iron.  
It is a calx. Molybdena resembles Plumbago. It  
always entirely volatile, & infusible in an open  
fire. It is affected by no acid, but the Nitrous & Sulfuric  
acid, & they only with the assistance of heat. The Mo-  
lybdenous acid distilled with three times its weight  
of Sulphur, reproduces Molybdena. Manganese  
contains Iron. Barytes is composed of Earth,  
Nit. acid, & water. Tungsten ~~contains~~ is a cal-  
careous earth, & contains Iron & an acid. Minerals  
thoroughly signify such ~~mineral~~ substances as are contained  
in Mines as Metals, Semimetals, Sulphur, & Salts,  
but more extensively they denote all fossils belonging  
neither to the vegetable nor Animal Kingdoms.  
Simple Earths are divided into 1. Calcareous, 2. Ponder-  
ous or Barytes, 3. Magnesia or Muratic. 4. Argilla-  
ceous. 5. Siliceous. Calcareous earth when pure  
constitutes lime. It is combinable with all acids. With  
the Nit. acid it forms Gypsum or Plaster. In the  
temperature of 60. it requires 630 times its weight  
of water to dissolve it. Specific gravity about 2, 3.



Terra Ponderosa or Barytes when pure requires 900  
times its weight of water to dissolve it. It is com-  
binable with acids, & decomposes Tartar. Vitriol.  
an effect which no other earth can produce. It  
is precipitable from the Nit. & Marine acids  
by the Prussian Alkali which properly dis-  
tinguishes it from all other earths. Siliceous,  
Crystalline, quartz, or vitrifiable earth.  
Mercury is a noble Metal. Mead says a  
Pound of Rhubarb contains 3/4 of Selenite.  
33 Pounds of Oak afford only 3 Drams of ashes.  
M<sup>r</sup>. Bergman found the ashes of some vege-  
tables to contain calcareous, Ponderous, Muratic,  
Argillaceous, & Siliceous earth, also sometimes  
an animal earth i.e. Phosphoric Selenite.  
Calcareous Earth is much the most frequent. M<sup>r</sup>.  
Morveau found the ashes of some vegetables to  
contain 97.5 percent of calcareous earth. The  
Mineral acids are Aerial, Vitriolic, Marine,  
Sulphuric, Succinic, Phosphoric, Molybdenic,  
Arsenical, & Tungstic. The Nitrous is not  
properly Mineral as it requires for its for-  
mation, the putrefaction of Animal or vege-  
table substances. Neutral salts consist  
of an acid united to either an alkali, earth,  
or Metal. The Nitrous acid is never found  
disengaged from all bases except in Charnels or  
Privies, but always united either to a alkali  
or earth. The tungsten acid is found only in  
the calcareous stone called Tungstein.  
Argill is not precipitable from the Nit. Nit.  
or Marine acid by the acid of sugar.



whereas all the others except the Ponderous united to the Vit. acid are. Calcareous Petrefactions are calcareous stones in the form of animal or vegetable substances.

Mr. Wall says the best test for discovering acid. Calcareous is the red Cabbage. To extract the blue colour, take the leaves of the cabbage that are greenest & have most colour; cut and the larger stems, slice the thin parts & digest them in water about the heat of  $120^{\circ}$  for a few hours. It soon turns acid & turns blue. For keeping, the leaves when minced are to be spread on paper, dried in a gentle heat, & put up in a close bottle. When wanted for use, make an infusion of them in water acidulated with Vit. acid & to the strained liquor, add whiting to absorb the acid, that is till the liquor is of a pure blue. The addition of a tittle of M. Viner will preserve it for some days in its blue state, but with the redundancy of acid, it may be kept for a considerable time & is to be neutralized with the whiting as wanted.

The brittleness of Gold induced by its mixture with Lead is owing to the Arsenic in the Tin, for 12 grains of regulus of Arsenic, injected into as many ounces of fine Gold, will render it totally unmanageable. Thus Scheele.

D. Withering says the alkalies decidedly precipitate Terra Ponderosa from the Nitrous & Marine Acids. Lime water of Terra Ponderosa is recommended for separating Marine acid from the Vit. acid with which it always is contaminated. The Mass of Terra Ponderosa with combination with fixed air will not in weak or strong fire, part with its air or burn into lime. This is owing to its want of water; for as common lime cannot unite to fixed air, without the intervention of moisture, so moisture may be an equally necessary vehicle for the union.

Ponderous Earth.

Dissolved in water precipitates on the addition of the smallest portion of vitriolic acid.

It is supremely insoluble.

It decomposes like Sal. via Humida.

With the N. H. Marine acid,

forms crystals that don't deliquesce.

Calcareous Earth.

Contrary



Fourscore's Chemistry.

Manganese is employed in glass houses for whitening or colouring the glass. Butters of Potimony is a solution of the Regulus by Marine acid which act on it with greater difficulty, than any of the other acids, & dissolves but a small portion however strong it may be.

Pyrrophorus is prepared by burning in an Iron Ladle three parts of Gum with one of Sugar Honey or Flour. This mixture is dried till it no longer bubbles up, & till it grows black; then it is poured into a matrass or Phial luted with earth. This vessel is placed in a crucible & surrounded with sand: it is heated untill a blue flame issues out of the mouth of the vessel, vial, & when it has burnt for some minutes, the crucible is taken from the fire, & left to cool. The Pyrrophorus which it contains is put into a vial that completely excludes the air. If this Pyrrophorus be exposed to the air, it soon takes fire, in proportion to the greater or less moisture of the Atmosphere. Its combustion is promoted by directing a moist vapour as that of the breath to its surface. The Pyrrophorus must not be too long heated, without this precaution, it no longer takes fire by the air. It is gradually loaded with humidity when kept in an unstoppered vessel & loses its combustibility, which may be restored by a new calcination. When Magnesia & the Alkali are both pure & anhydrous they do not decompose the Calcareous salt, because they have less affinity with the acids than Lime.



but when they are united to fixed air, & in the  
state of aerial Neutral salts, they then become  
capable of decomposing the calcareous Neutral  
salts by means of double affinities. The Alkalies  
lime, & Magnesia decompose the salt with  
base of clay. &c

The Academicians of St. Petersburg con-  
grated Mercury at  $125^{\circ}$  below 0 of R. Thermometer.  
The Sp. Vm. stood  $40^{\circ}$  below 0 of F. Thermometer.  
The following is an easy process invented by  
M. Scheele of making sweet Mercury, viz equal  
parts of Mercury & Ag. fort. are mixed together in  
a long necked Matrass which is to be placed in  
a sand bath; the heat is raised till it nearly  
boil & kept so three or four hours, then it is made  
to boil for 20 minutes. In this state it is poured  
into a solution of salt which is also at a boiling  
heat: care being taken to keep the mixture  
in constant motion, till the whole addition be  
made. After the precipitate settles, the clear  
liquor is to be decanted off, & the precipitate  
washed with hot water, till the water comes off  
tasteless. The proportion of the Ingredients is Ag.  
fort. & Mercury  $\text{aa } 4$  parts, Common salt  $3$   
parts, & water  $40$  parts. The precipitate thus  
prepared has all the properties of the best sweet  
Mercury. It is perfectly insipid, & also gives  
a black colour, with caustic alkali, & lime wa-  
ter like common sweet mercury, & mixed with  
red arg. v. it takes up none of it, & the  
powder finer than any that can be made from  
the common sublimed calomel by any treat-  
ment whatever. —



Mr. Hamilton says the Giant Causeway pillars consist  
of the Columnar Basalt of primitive form.  
Basalt is a black, ponderous close grained stone  
that don't effervesce with the Mineral acids. Specific  
gravity as 2.90 to 4.00 very compact. Strikes fire im-  
mediately with Steel. fusible per se readily. With  
an alkali flux it forms an opaque glass of a black  
or bluish colour. Torbern Bergman's Analysis of it is  
as follows; viz. Basalt 100 parts

Contains siliceous earth - 50 parts

Argillaceous do. - 15

Calcareous do. - 8

Magnesia do. - 2.

Iron - do. - 25.  
100

Lava, & most volcanic  
substances are fusible  
per se.

Mr. Watt's thoughts on Water, & Air. Transac Phil. 1784

D. Priestly found by reviving the calces of metals in  
a vessel cont. nothing but inflamm<sup>e</sup> air, that inflamm<sup>e</sup>  
mable air is real Phlogiston in an aerial form.  
Deph. inflamm<sup>e</sup> air ignited by Electric spark generates a great  
degree of heat, which pervades the glass & being diffused in the  
circumambient air, pure <sup>water</sup> is produced exactly equal in  
weight to the air employed. A vacuum is produced in the vessel.  
Water, light & heat are all the Products. Hence water is com-  
posed of Deph. air & Phlogiston deprived of a part of its latent  
or elementary heat. Deph. air is composed of water deprived of  
its  $\Delta$  united to elementary heat. Light is only a modifica-  
tion of heat, an attending circumstance or a component part  
of inflamm<sup>e</sup> air. Deph. water, the basis of water & air, or steam  
more powerfully attracts  $\Delta$  than latent heat, but can't unite  
it to the point of saturation or the total expulsion of the latent  
heat without being made nearly red hot. Deph. air was obtained  
by exposing to heat in the same vessel clean Iron filings (which



alone produce only the purest inflammable air.  $\Delta$  & Calcinates per  
sic (which gives only  $\gamma$  purest deph. air.) Deph. & inflam. air will  
remain for years in a close vessel in the heat of  $\gamma$  atmosphere  
unchanged. Fixed air has more  $\Delta$  than Phlog. air. The latent  
heat cont. in steam diminishes in proportion as the sensible  
heat of the water from which it is produced, increases. Acid.  
Nit. has a greater attraction for  $\Delta$  than any other substance. When  $\gamma$  Nitre  
is melted or made red hot the acid acts on the water, & Phlog. initiates  
it & the fire supplies the humor with a due quantity of heat to  
constitute it air, & it thus immediately issues. Nitre yields  $\frac{1}{2}$  of its  
weight in  $\gamma$  form of deph. air. 3ij of Nitre by distillation give 800  
ounce measures of Deph. air. Nit. air & common air make Nit. acid.  
Nit. acid does not enter into the composition of Deph. air. 2189 grs of Purity  
240 grs. were reviewed, & all the deph. Nit. acid employed is highly phlog. ing  
Process. The Nit. acid comes over in the receiving water almost entirely.  
Phosphoric & Arsenical, nay perhaps any acid that can bear a red  
heat concurs to the production of deph. air; all that do have a strong  
affinity for  $\Delta$ . Deph. air obtained from the pure calces of Metals may  
be attributed to  $\gamma$  values themselves, attracting  $\gamma$   $\Delta$  from water which  
they have imbibed from the atmosphere, or from dephlog. initiating  
the fixed air they are known to contain. Nit. air contains  $\Delta$  water  
& Nit. acid. In the combustion of Sulphur, the Nit. acid having a much  
weaker attraction for  $\Delta$   $\gamma$  air has abandoned it almost entirely to the latter  
which is thereby converted into water & in that form attracts the Nit.  
acid & reduces it to a liquid state. One Paris ounce of Deph. air,  
when decomposed by burning Phosphorus, melted 68, 634 oz. of Ice  
which on being melted absorbs 135 of heat. 576 grs. of Deph. air  
require 120 grs. of inflammable air or  $\Delta$  to convert it into water; this  
union extricates 9265 of heat. Elastic fluids are enlarged in  $\gamma$   
dimensions in proportion to  $\gamma$  quantity of heat they contain. The  
latent & sensible heat of the steam of boiling water is 1100°. It is more  
than twice the bulk of an equal weight of deph. air; contrary to  $\gamma$   
general rule in the sentence above immediately before. The attrac-  
tion of the particles of matter to one another is increased by  $\Delta$  & bodies  
are thereby rendered specifically heavier. Nit. air is decomposed, &  
gradually converted into Nit. acid by the admission of common air.  
Nit. acid saturated by an alkali will not crystallize, & if  
exposed to evaporation even in the vacuum in the heat of the air will  
come alkaline again; this acid is expelled by all the acids, even  
regas. Litmus is not of its saturation by Alkalies.



D. Priestley on Air. Twelve ounce Measures of  
D. Air weigh six grains. Iron during fusion appears to  
boil or throw out Air, but it actually imbibes Air & when  
saturated the fusion ceases. In this case it gains nearly  
one third of its original weight. The proportion D. Air  
& inflamm<sup>66</sup> Air to produce water by firing is 2 measures  
of the latter to one of the former. The quant<sup>ty</sup> of inflamm<sup>66</sup>  
Air disappearing in the receiving of a calx of iron or  
slag was 5 1/2 ounce measures, while it got as much as  
the weight of about 3 ounce measures of D. Air & the  
water collected weighed 2 grains. This slag became  
perfect Iron as at first. The quantity of water produc<sup>ed</sup>  
ed greatly exceeded the weight of all the inflamm<sup>66</sup>  
mable Air. Water was produced in the same manner  
from the calx of copper, & precip<sup>itate</sup> per se. Charcoal  
& Iron intensely hot have a powerful attraction  
for water. Water is essential to the produc<sup>tion</sup> of Iron.  
Air & even enters into these constituent principles  
hence inflamm<sup>66</sup> Air is not pure. Charcoal & Iron  
will find & attract it in the middle of the hottest  
fire. Large quantities of inflamm<sup>66</sup> Air were pro-  
duced by transmitting water through hot iron, &  
copper tubes cont<sup>aining</sup> charcoal. Water after being  
made red hot is still water & has no change in its  
sensible properties. The inflamm<sup>66</sup> Air came principally  
from the charcoal or Iron. 16 3/4 ounce measures of iron  
combined fixed Air weigh 15 1/2 gr. The Phlogiston cont<sup>ained</sup>  
in 392 ounce measures of fixed Air is nearly 69 gr.  
Water & fixed Air consist of the same ingredients.  
Inflamm<sup>66</sup> Air comes only from the Iron as the g<sup>as</sup> of water



of expended added to the weight of the Air produced was found  
to be the addition of weight gained by the Iron. With the ad-  
dition of 267 gr. to 29 quantity of Iron & the loss of 336 gr.  
of water, I procured 240 ounce measures of Inflamm. air  
the lightest kind & the cheapest method. 960 gr. of Iron  
dissolved in acids yield about 80 ounce measures of air,  
but a copper tube filled with the same quantity of  
Iron turnings yield by the admission of steam 1054  
ounce measures weighing only 83 gr. & the Iron turnings  
had gained 329 gr. in weight. The Iron melted in D. air  
is apt to form fixed air & part remains to form D. air  
& 3<sup>d</sup> air & imbibes & scale of iron is intimate union of  
the earth of Iron & water, the same salt thus saturated  
is heated in inflamm. air, this enters into it & destroys  
the action between water & the earth & revives Iron  
while the water is expelled in its proper form. The scales  
of Iron are the same substance in all respects with Iron  
melted in D. air or saturated with steam by means of heat.  
The scale of Iron imbibes inflamm. air & heated is produced &  
Iron itself imbibes D. air & fixed air is produced. No inflamm.  
air is procured from substances said to contain no A.  
therefore A is a real substance capable of assuming the  
form of air by means of water & heat. Cast Iron annealed  
differs remarkably from cast Iron unannealed, the former is  
much more soluble in acids. Water was produced by re-  
viving precip. ferrous as well as scales of Iron & copper saturated  
with D. air. & no fixed air was found in what remained  
of the Inflamm. air. Iron melts more readily in D. air  
than in D. air. Water don't contain so much A as Iron  
& fixed air remains after the calcining of metals. The  
proportion is as 12 to 10.4. D. air is to Inflamm. air as 5 to 4.  
Mr. Kirwan says. B. Wallis's experiments prove that  
from a few degrees above the freezing to the boiling point  
water is dilated about 16 of its bulk. If 1000 ounces at 32°  
be equal to cubic foot, they must be equal at 212° to cubic foot  
66.46 cubic inches. The expansion of liquids by equal degrees  
of heat is much greater than that of solids.



Pure Spirit of Nitre can exist in the form of air.  
for when it's deprived of water, & Phlogiston, & fur-  
nished with a due proportion of elementary fire, it  
becomes Depl. air.

### Bergman's Expts.

Nothing is known concerning bodies a priori, but their Nature &  
diff. properties are discovered a posteriori by observation & experiment.  
The purity of truth is corrupted by preconceived opinions con-  
cerning the Genesis & metamorphosis of matter. Reasoning, Experi-  
ment are the two foundations of Nat. Philosophy. The composition  
of a body is only truly known by Analysis & Synthesis. Terra ponderosa,  
Magnesia, Lime, & the Alkalies respectively form with different  
acids quite different compounds. Pure Chalk dissolved in Marine acid  
& precipitated by caustic alkali, the precipitate agrees with  
lime burnt & slacked for it's insoluble in water & raises no  
effervescence in acids. The precipitate of a Metal dissolved in an acid  
& separated by a fixed alkali is a calx, but separated by another  
metal the dissolved metal itself is recovered, only very minutely  
divided. Mild alkali in certain cases produces a much  
heavier calx than the caustic, the calx absorbing the aerial acid.  
The diff. acids occasion only a greater or less privation of Phlogiston.  
Mineral fluor yields it's acid by heat & the application of Vit. acid.  
acid. We never profit more than by those unexpected events of  
experiments which contradict our analogies & theories. The  
effervescence arising from a mixture of chalk & Vit. acid is not  
attended with any increase of heat. Chalk well burnt put  
into Vit. acid excites a violent ebullition quite different from  
effervescence with 100° of heat. Words as well as Money have an  
ideal value. Neither pure Vit. nor Vit. acid can be resolved into  
permanently elastic fluid but may by the addition of Phlogiston.  
Marine acid is by itself resolvable into Phlogiston. Fixed air  
is used in two acceptations viz more extensive, or more limited.



former for every elastic fluid set free during the decomposition of bodies.  
The latter for that species of air extracted from alkaline salts  
by fire or acids, & from vegetables during fermentation.  
fixed air should be passed thro' water to free it from the Volatile when used.  
The heat must not be too great nor the acid too much. Phlogisticated acids  
being extremely volatile will rise with the air. Calcareous earth  
naturally contains Marine acid which is volatilised by calcination. Calcareous  
earth retains fixed air much more obstinately than Magnesia. The  
stop of the Retort is prevented from flowing by the violence of the heat by  
surrounding it with Gypsum, which by cementation makes it more  
fracture. In 41 of R. Turner's water will absorb a quantity of fixed air more than  
at a still in bulk, though absorbed is less in proportion to increase of heat.  
specific gravity of saturated water is to that of distilled water as 1,0015 to 1,000 in  
Congelation separates fixed air readily from fluids. The more aerated water  
with neutral salts the more closely the two principles cohere, the less  
is the compound & vice versa. Cold strengthens & heat loosens the union  
the water with the air. Alkalis can be supersaturated with fixed air.  
R. Turner. Tart. tartaric. calomel. corros. sub. Vol. acid. & A. Several acids alter  
by R. Turner. 100 parts of pure veget. alkali requires nearly 42 of fixed  
air to saturate them, & complete calcination effects both the air & water  
saturation. The former. Saturated fixed, crystallized alkali neither de  
liquesces in moist nor effloresces in dry air, 100 parts of this contain 32  
of water, 20 of fixed air & 48 of pure alkali. Causticity is not owing to  
the acid & A. from Sulphur & all acids are dulcified by Vol. Vin.  
Phlog. Vol. & A. acid are expelled by concentrated vinegar. Causticity  
defined a tendency to combination with the living body. Caustic  
alkali first deliquesces exposed to the air, & then by absorbing fixed air  
saturation & crystallizes. Pure fixed alkali precipitates a ferrous  
mercurial salt but when fully saturated with fixed air precipi  
tates a white one, & white colour depends upon fixed air adhering to  
the mercurial salt. The more the dissolved mercury is impregnated with  
the fumes is the precipitate by fixed alkali & contra. The Marine &  
Vol. acids are in general mixed with salts extracted from Vegetable ashes.  
Mineral alkali obtained from Marine Plants is called Sal. Soda  
100 parts contain 16 of fixed air, 64 of water, & 20 of pure alkali. Vol. alkali  
possesses the power of dislodging all other alkalis from acids & requires  
42 parts of fixed air to the 100 to saturate them, the Mineral 80 to 100.  
the stronger the simple salts are the more easily they are saturated  
crystallized Mineral alkali dissolves in a moderate heat in twice its weight  
of water. 100 parts of pure Vol. alkali requires nearly 100 to saturate them  
the greater efflorescence. Terra ponderosa saturated with Vol. acid  
forms the Spatum ponderosum or marmor metallicum.



900 parts of water take up only one of pure Terra ponderosa. It like  
lime in many respects blackening More. dule & colouring the <sup>la</sup>strachasia  
precipitating corrus sub. in a yellow powder. It forms quite diff. com. got  
pounds with the Mineral acid from calcareous earth. Boiling the pure  
totally detaches the fixed air from water. Pure lime is wholly dissoluble  
in water but 700 parts of water completely purged of fixed air will dissolve  
is the best scarcely takes up 1 part. Fixed air diminishes the solubility  
of Sal. Alkali & Terra ponderosa. & this acid produce the same effect  
1 part of Tart. vit. requires 16 of water to dissolve it. Nit. acid can't. The  
separate exhibited in a separate state from water, it's attraction  
for it is so great. Tart. vit. Gypsum & other salts deficiently soluble  
are easily taken up by water acuated by an acid; thus lime is  
dissolved by a superabundant acid. Causticity is explained simply by  
elective attraction. Quicklime don't stick in fixed air but may in  
aerated water, hence water is a necessary intermede to the union of  
the Gas. The land demonstrated of alkaline salts also holds good of earths  
Silicious earth eludes the force of all the acids but the Mineral fluxes  
Fixed air don't dissolve the metals with the water. Inflamm. matters greedily  
attract fixed air. Olive Oil absorbs an equal & sometimes a greater bulk  
than its own. It difficultly combined with pure Allogiston. Rancidity  
of oils is owing to the dissipation of fixed air, & is prevented by  
restoring it. Aerated as well as pure Vol. alkali attack copper. Soap  
is hardly decomposed by fixed air. Zinc precipitates all the other metals  
from menstrua. Silver dissolved in Nit. acid is more easily precipitated  
by aerated than by caustic alkali, & the precipitate is heavier. Mineral  
By union of fixed air Vol. alkali is made more fixed, less odorous  
& penetrating, & crystallizes. It precipitates substances dissolved  
in pure Alkali. Electrical fire generates fixed air. Marine acid  
& Vol. Alkali spoiled of  $\gamma$  & are resolved into elastic vapours.  
In the Grotto del Cave the noxious vapour is fixed air that rises  
not above a foot from the Ground. Sea water taken at the depth  
of 60 fathoms has no smell & the taste intensely salt but not  
all nauseous like that at the surface. I have of this Sea water  
contained of Sal. com. Zij. 5. 433 of salited Magnesia. 380.  
of Gypsum 44. The pure access of air to a sufficient quantity of  
Salt promote the putrefaction of the various animal & vegetable  
matters at the surface. Acid of Sugar is got from Sugar by Nit. acid  
It attracts lime from all other acids. Dec. Bayen congealed Nit. acid  
in 2 or 3 of H. Potashes are generally mixed with the acid & Silicious



equal quantity of Sal. Epsom. & that ash is necessary to procure Mag-  
nesia but only half the weight of alkali of Tart. is requisite. The best Magn.  
is not from Sal. Epsom. 100 parts of Sal. Epsom produce 42 of acid & 25  
of pure Magnesia. The last Lixivia of Nitre & Sal. com. that refuse to cry-  
stallize contain Magnesia dissolved in Nit. or Marin. acid & the Magnesia  
collected by precipitation, evaporation to dryness & calcination. The Min.  
alkali properly crystallized are free from silicious earth. W. Bergman  
contains the compressibility of water in its fluid state.  
The earth of animal matter consists of a calcareous substance com-  
bined with the acid of Phosphorus. Phosphorus is made by separating this  
acid & combining it with inflammable matter. Calcined Hartshorn mixed  
with charcoal gave no phosphorus by distillation; a salt made of the acid of  
phosphorus & fixed alkali gives no phosphorus. This acid has a stronger at-  
traction to calcareous earth than to Alkali. This acid is obtained by digesting  
Hartshorn with the acid of Nitre but not with acid of Vit. which forms a Solu-  
tion of tartar. It is required to form sulphur than phosphorus. The same product  
is obtained from bones as from Hartshorn. Bergman says viz. Phosphorus  
analysed & confirmed by Synthesis. It must be conducted in the hemisphere.  
Distill. Calcareous Spar & Vit. acid are best matters to yield fixed air. Mag-  
nesia scarcely ignites emits its fixed air with ease. In order for fermentation  
it is sufficient that an agit be allowed to a elastic fluid. 2 hour boiling will  
drive water of its fixed air altogether. Longelation separates it completely.  
Water saturated with fixed air a little above freezing point emits very little  
or flavor but when set a few minutes above 60° it gradually evolves its taste  
by cooling strengthening union of 2 bodies by which its sapidity is blunted.  
It only changes Turnsol. Indigo not altered by highly concentrated Vit. acid. Pure  
alkali of tartar saturated with fixed air forms into crystals which neither  
liquefy nor effloresce. They dissolve in 4 times their quantity of water. Alkali  
of tartar is sweet. It naturally forms crystals of eight sides. Crystallized  
Mineral Alkali effloresces in dry air. Caustic Vit. alkali is always in a fluid  
state. Rendered mild by fixed air it is disposed to crystallize. The weaker  
the simpler salt the greater proportion of fixed air it requires to saturate  
than Vit. alkali more of fixed. The heat imparted to water by nit. burnt lime  
gives a loose adherence of matter of heat which is repressed. Lime that generates  
it is not entirely deprived of its fixed air. If the fixed air be entirely expelled  
the lime is dead & inert & soluble but causes no heat nor inflation in sticking.  
Magnesia peculiar earth. Distilled water dissolves 850 of Magnesia. Boiling  
water necessary in making Magnesia. Fix. air in its elastic state don't dissolve or cor-  
rupt any of metals. Fixed air only affects Iron, Zinc & Manganese of metals.  
Fixed air loaded with & by drawing electrical sparks through it  
unit in union with the water. Silicon unite with alkalis & is perfectly  
soluble. Solution of alkali of tartar repeated filtered separates earth of silicon  
superficially of air or fixed air. Red sand to Potashes. Air acid precipitates sub-  
stances dissolved in pure alkali. It is not a simple & double electric attraction  
fixed air immediately extinguishes a body red hot & glowing. It strongly at-  
tracts smoke & holds it a long time. The lungs of animals killed by fixed air don't  
sink in water like those of an animal killed in vacuo. inflamed, right side of  
Pulmonary Artery. There is a singular & capillary brain diffused in blood  
stability of muscles destroyed. Direct die first then does then Amphibia  
Earth Insulator



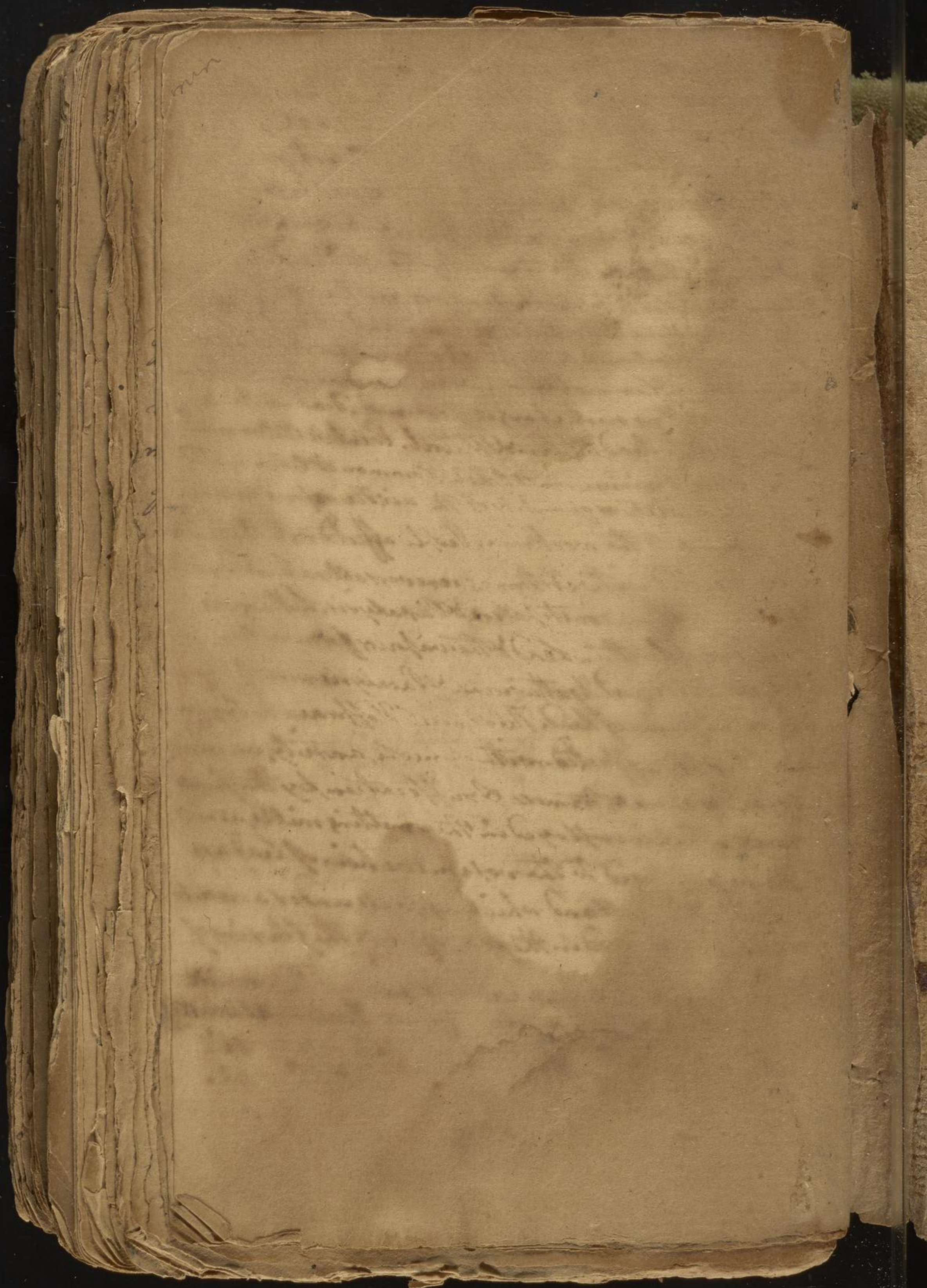
M<sup>r</sup>. Nikin, White & Goulard maintain the innocence of the external application of preparations of Lead. Dr. Percival & Dr. Baker believe that Lead sometimes produces its specific effects upon the body. Dogs, Cats, Horses, Cows, Poultry, Birds, & Fish are violently diseased with Colic, constipation, convulsions & Madness & are ravenous by receiving Lead in any form into their bodies. They are greedy of it to excess. The vapours of Lead in smelting furnaces, & the waste & smeltum carried on the grass, destroy its verdure. Colica Pictonum is cured by a vomit, laxatives, & oil clysters, the Ol. Ricin. is the best. Gum is very good both as a Prophylactic & remedy in the Colica Pictonum, gr. ℥. 4. 5. <sup>a</sup>℥. 6. <sup>to</sup> usage. Gum? mostly prove gently aperient. It advantageously combined with Gum Arab. or Gumma Ceti. - It abates flatulence, obviates spasm, improves the appetite, & strengthens the organs of digestion by its immediate action on the nerves it obtunds the morbid sensibility of the intestines. The Miners & smelters of Lead when affected with the Colic find an effectual & speedy remedy in the nephetic or fixed air arising from the calcination of Lime Stone. The Men employed in burning Lime are remarkable for their health & longevity. Smelters of Lead broil their meat on Pigs of hot Lead which gives them a very agreeable Flavour. Decant & Fish get the bellend. Pot metal & Brass cocks consist of equal parts of copper & Lead with a little litharge & antimony



Hard water renders Potter black. Fixed air don't dissolve  
 Lead. Humorous waters don't dissolve Lead. Lead is easily  
 vitrified by sand & Kali & is an ingredient in the glazing of  
 Queen's ware or Burslem Pottery. White Lead Paint greatly in-  
 creases the air & diminishes it in quantity. This air is rendered  
 wholesome by agitation in water. Nit. Air is obtained from the  
 metals & semimetals by except zinc, by the Nit. acid. When one  
 part of this air is added to two parts of common air the mixture be-  
 comes hot, turbid & of a red colour & is diminished nearly  $\frac{2}{3}$  of its bulk.  
 These effects are proportioned to the fitness of the air for respiration.  
 With mephitic, inflammable or any noxious air, no chemical  
 union is formed & no such changes produced. Dead white is a  
 composition of white lead, Oil Lin. & Pitch. Painter's Oil is made  
 by boiling Litharg. & minium in Oil Lin. Common Oil Lin. neither  
 diminishes the quality or quantity of the air. The vapour of arsenic  
 is not prejudicial to the workmen. People affected with the fumes  
 of Lead are troubled with Asthma universally attended with  
 blue expectoration, constipation & Paralysis. Litharg. is  
 much more volatile than Lead & the vapour forms a thin  
 yellow or greenish crust. Aguttes & Paralysis were the con-  
 sequences of the fumes of Lead. Haldane & Hoffman both give  
 instances of People affected with syncope, anxiety, vomiting,  
 diarrhoea, dyspnoea, tremors & suffocation, by the fumes  
 of Arsenic. People employed in the smelting mills, as well  
 as other animals exposed to the noxious action of Lead are  
 afflicted with the belland which appears under a variety  
 of disguises. Holly wood in the fire renders the fluxing of  
 Lead ore.

parts of Mineral alkali	100 parts of pure Vegetable	100 parts of vit. acid require
Quint	Kali require	of pure Vegetable alkali
Acid 177	Of vit. acid 782	Mineral - 562
135 1/2	- 64	Volatile - 42.
Marine 125	- Marine 58 1/2	
Seriat 30	Aerial 42	







*Erone capillata, postest occasio calvar.*  
*Præter naturæ voce doceri quam ingenio suo sapere.*  
*Thucydides, matter of heat, or latent heat. Cicero.*

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